MODERN PLASTICS

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JULY 1946

MODERN PLASTICS

VOLUME 23 JULY 1946 NUMBER 11

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They're Lovely...

A few of the thousands of products that can be made from GEON raw materials

Boldly but beautifully colored shower and window curtains... a delicately shaded shower cap... baby's modern spotproof bib and mother's gay apron... sister's stylish raincape...

All these were fabricated from flexible films made from GEON raw materials. But they're only a handful of the thousands of exciting new products that can be made from GEON. For versatile GEON may be pressure or injection molded, extruded, calendered, cast into sheets or film, or applied as coatings to all types of textiles and papers.

And products made from GEON may have any number of unusual properties in a wide variety of combinations. For example, products made from GEON may be made resistant to water, oils, acids, foods, air, heat, cold, abrasion, mildew, cracking, creasing, and many other normally destructive factors. They may be brilliantly or delicately colored; flexible or rigid; transparent or opaque. There are applications for GEON in literally *every* home, *every* industry.

For more information about GEON please write Department I-7, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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B. F. Goodrich Chemical Company

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Serving Baby Better

WITH MOLDED PLASTICS

Even baby's high chair has gone modern with the new molded plastics tray featured in the Safe-T-Bilt line of high chairs, made by the Williamsburg Chair Factory, Williamsburg, Ohio. Designing and planning of the tray came as an outgrowth of a consultation between Williamsburg Chair Factory officials and a CMPC Development Engineer.

The material selected for the tray was high-impact melamine, which is resistant to frequent washings with boiling water and soap, and to spilled fruit juices and other liquids, as well as being tasteless and odorless. Furthermore, melamine is easily molded to an adequate depth to prevent accidental spilling of foods, liquids or toys upon the floor.

The molded melamine tray overcomes the limitations of the conventional wood tray, and it has been well received by the retail trade and by parents alike. It is considered one of the best business building features ever added to the Williamsburg line.

Here's another example of a job done better with molded plastics—a high chair tray with features unattainable with other methods. It's an example, too, of the careful planning of CMPC Engineers—the precision mold making and efficient production which have won for CMPC a nation-wide reputation for quality in molded plastics. A CMPC Development Engineer is at your service for discussion of any molded plastic application. Just drop us a line. No obligation.

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MODERN PLASTICS is regularly indexed in the Industrial Arts Index and in Industex.

Bigger and Better Plastics Exhibits

The First National Plastics Exposition is history—enough time has elapsed to reflect soberly upon its consummation and give serious thought to its perpetuation.

Since the attendance figure of 83,100 set a new record for an industrial show at the Grand Central Palace, it is quite obvious that the show was a success from the spectator viewpoint. It is essential for the industry to protect, and improve upon, that high-grade reputation. With this in mind, the editors of this magazine have talked to as many exhibitors as possible to obtain their reactions to the plastics industry's first big splash as an industrial entity. We are presenting their most frequent suggestions to encourage discussion toward the end that next year's show may be even more impressive.

Nearly every one believes that plans for the 1947 exposition should be started at once so that exhibitors may have more time to prepare for their participation. Most of those interviewed favored a rotating schedule for the exposition over perhaps a four-year span so that plastics products may receive equal attention in all parts of the country. Besides New York, the cities of Chicago, Cleveland and St. Louis were mentioned repeatedly as possible locations with a further thought that a regional show be held on the Pacific Coast at least once every four years.

Some complaints were registered because the first three days, supposedly reserved for the trade, brought a heavier attendance than the last three days given over to the general public. The figures were 49,700 as against 33,400. Critics thought a more stringent control of ticket distribution might be devised so that the first three days could be devoted exclusively to the trade. Another oft-quoted suggestion was that the concurrent S.P.I. Conference be held to a minimum number of technical meetings so that members could devote more of their time to the show.

An idea frequently discussed among those interviewed was that S.P.I. appoint an actual working committee made up of exhibitors who have had long experience in similar industrial expositions. Such a committee would, of course, be responsible to S.P.I. as the guiding hand but would formulate plans based on the most successful operations as practiced by other industrial groups. This committee would be required to keep in close touch with all exhibitors and give them an opportunity to voice grievances or make suggestions. The plastics exposition is for the benefit of the entire industry and extreme care should be taken under democratic procedure to see that those who take part in the show receive equal consideration.

The above suggestions were made in no spirit of carping, but to point out dangers that exist in the future despite a belief that this exposition was one of the most outstanding of all industrial shows.

There was some complaint from molders that the raw materials and machinery exhibitors stole the show. There isn't much doubt that the spectators were fascinated by what they found on display at the raw materials suppliers' booths. Those exhibitors who gained public attention used dramatic effect to draw in the spectator. The molder can capitalize on that interest just as profitably as a supplier, as many of them did at the exposition, if he gives the same care and planning to his exhibit that he would to a sales campaign.

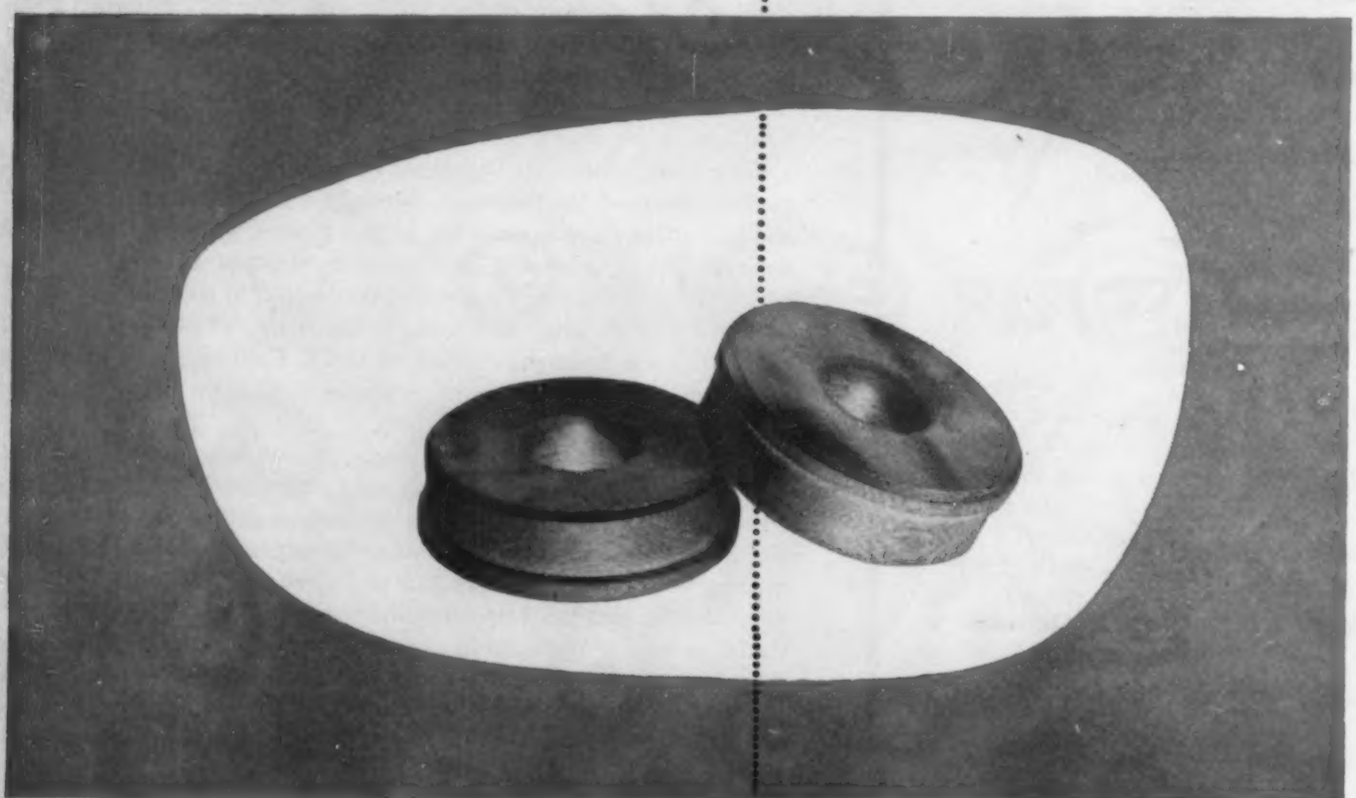
Case Histories from the RICHARDSON *files*

PRODUCT RE-DESIGN

Problem: *To re-design bearings on bottle vending machine. Must be non-corrosive to withstand moist atmosphere. Bore of finished part must serve as a non-lubricated bearing, while the outer periphery must resist abrasive action.*

Solution: Using Laminated INSUROK, Grade CG, Richardson Plasticians furnished precision plastic bearings having the required characteristics. For Grade CG INSUROK contains a high percentage of natural graphite, has excellent strength qualities, resists abrasion and the action of moisture.

The versatility of The Richardson Company is at your service no matter what the plastics application may be. Through the correct use of INSUROK, both *molded* and *laminated*, Richardson Plasticians have shared in the rapid growth of many industries. Tell us your plastics problems . . . and let us help you solve them!



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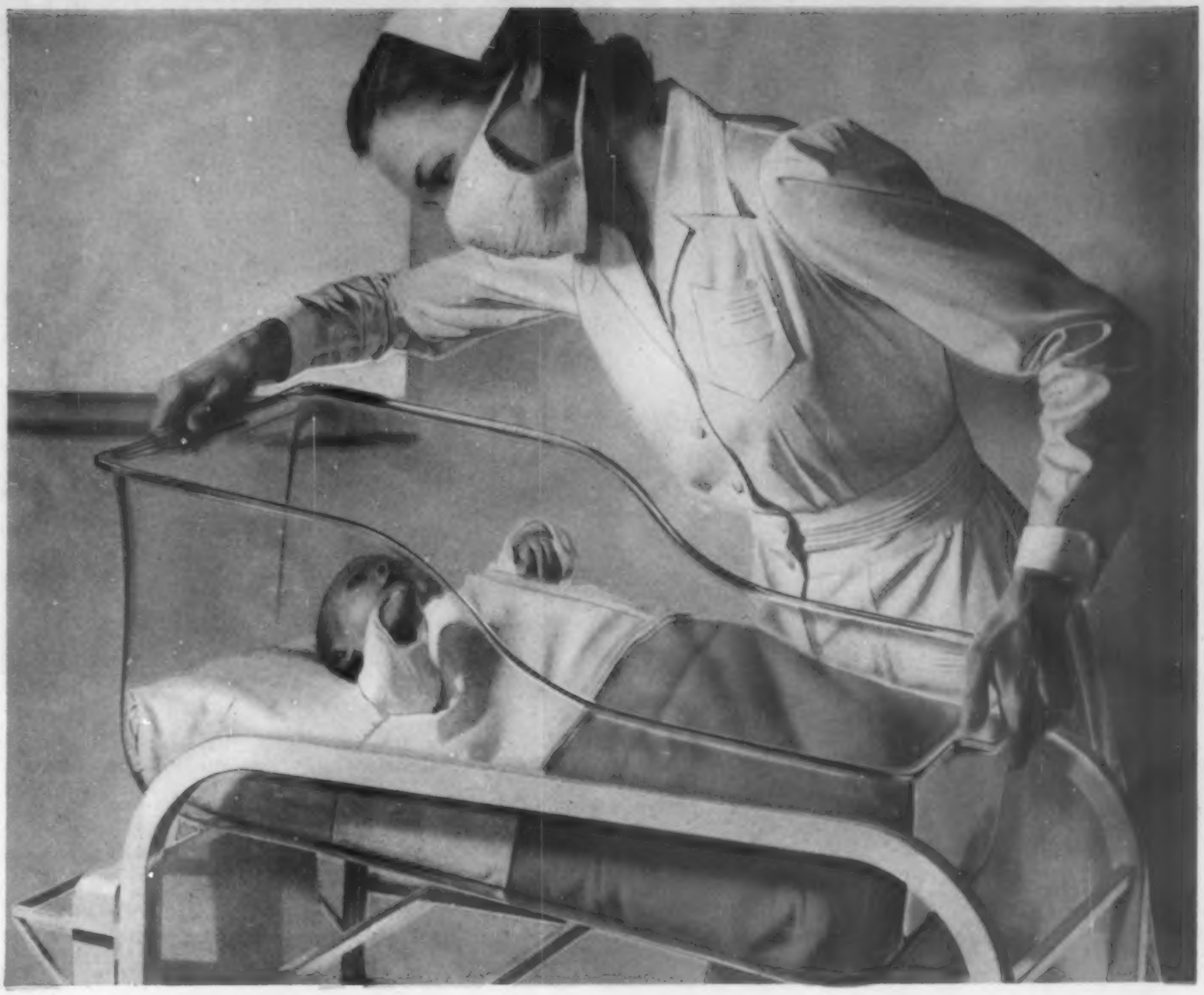

HE'S SAFE . . . HE'S IN SIGHT . . . HE'S IN "LUCITE"

WHAT'S NEW

Tumblers of molded nylon are translucent, light-weight, attractive, and pleasant to the touch, yet they stand hard knocks, hot drinks—and steam-sterilizing. Dropped on concrete terrace or tiled bathroom floor . . . they do not break. Manufactured by DuBois Plastics, Buffalo, N. Y.

No drafts reach *this* baby! Yet his nurse can always see him. He's safer, that's sure, than the infant surrounded by blankets in the old-style bassinet.

For filling this long-standing hospital need, credit the man who discovered that this transparent, sanitary "baby-basket" *could be formed from a single sheet of Du Pont "Lucite."* The light weight of "Lucite" acrylic resin makes the product easy to handle . . . its strength helps make it last for years.

Thus another new and better product steps into a market ready and waiting . . . because of a man-with-an-idea who knew his Du Pont plastics.

Just so, in *many* fields new products are made more beautiful, more serviceable, more salable by one or more of the Du Pont plastics. These all help to show that the manufacturer who knows these plastics well has a big head start over the man who doesn't. Write for literature on these plastics today. E. I. du Pont de Nemours & Co. (Inc.), Plastics Dept., Room 367, Arlington, N. J.

The "Infanette" is made by W. P. Campbell Mfg. Co., Los Angeles, Cal., for American Hospital Supply Corp., Chicago, Ill.

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Plastics

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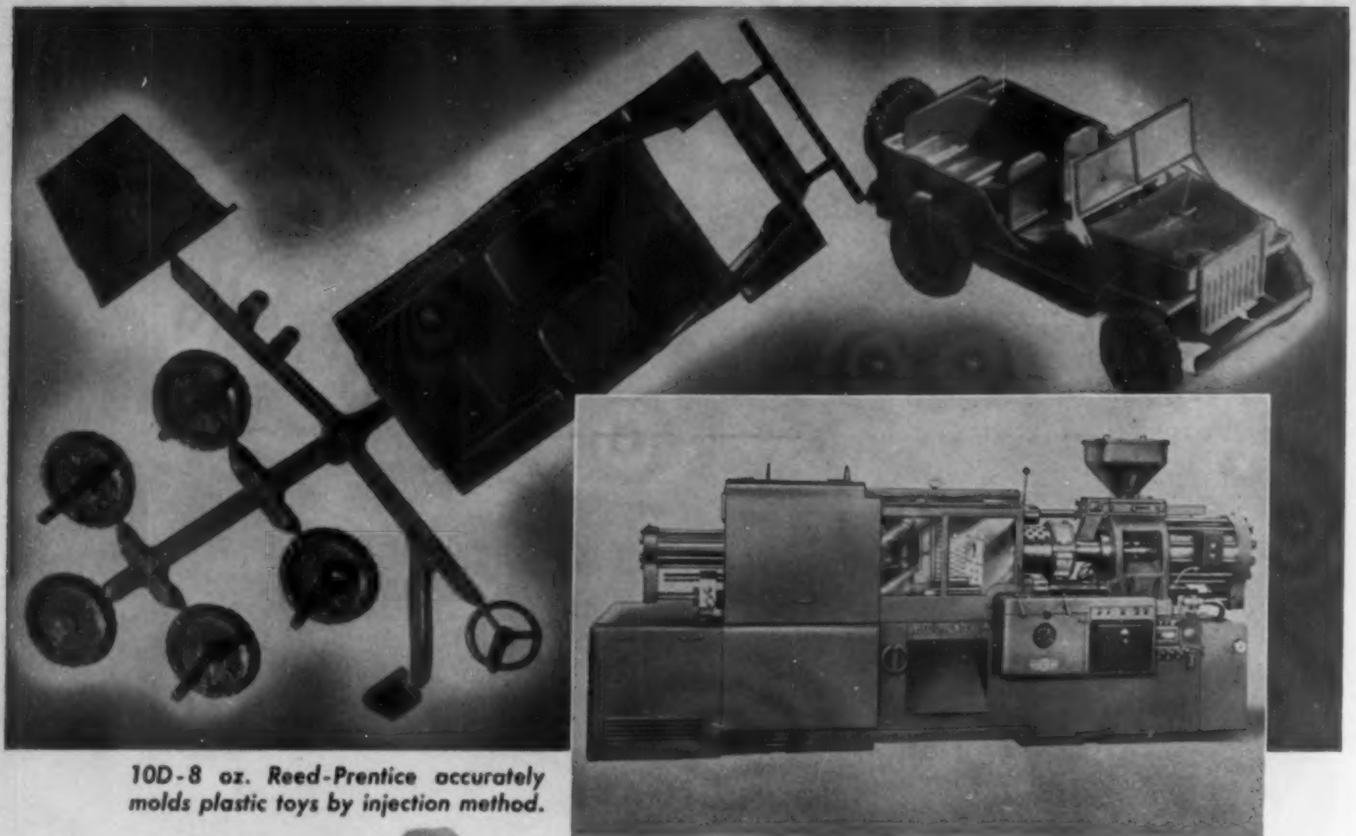
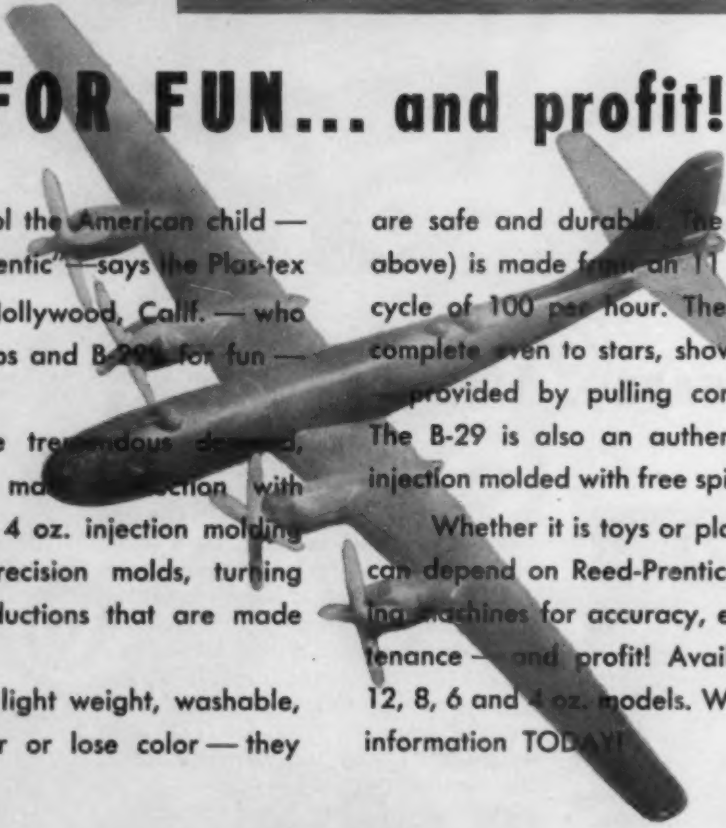


10D-8 oz. Reed-Prentice accurately molds plastic toys by injection method.

MOLDING FOR FUN... and profit!



"You cannot fool the American child — his toys must be authentic"—says the Plas-tex Corporation, West Hollywood, Calif. — who mold plastic toy Jeeps and B-29's for fun — and profit!

Recognizing the tremendous demand, Plas-tex went into mass production with Reed-Prentice 8 and 4 oz. injection molding machines — using precision molds, turning out miniature reproductions that are made to exact scale.

Plastic toys are light weight, washable, do not dent, splinter or lose color — they are safe and durable. The Jeep (see sprue above) is made from an 11 cavity mold at a cycle of 100 per hour. The finished Jeep is complete even to stars, shovel, pick and axe — provided by pulling cores in the mold. The B-29 is also an authentic scale model, injection molded with free spinning propellers.

Whether it is toys or plastic parts — you can depend on Reed-Prentice injection molding machines for accuracy, economical maintenance — and profit! Available in 22, 16, 12, 8, 6 and 4 oz. models. Write for complete information TODAY!

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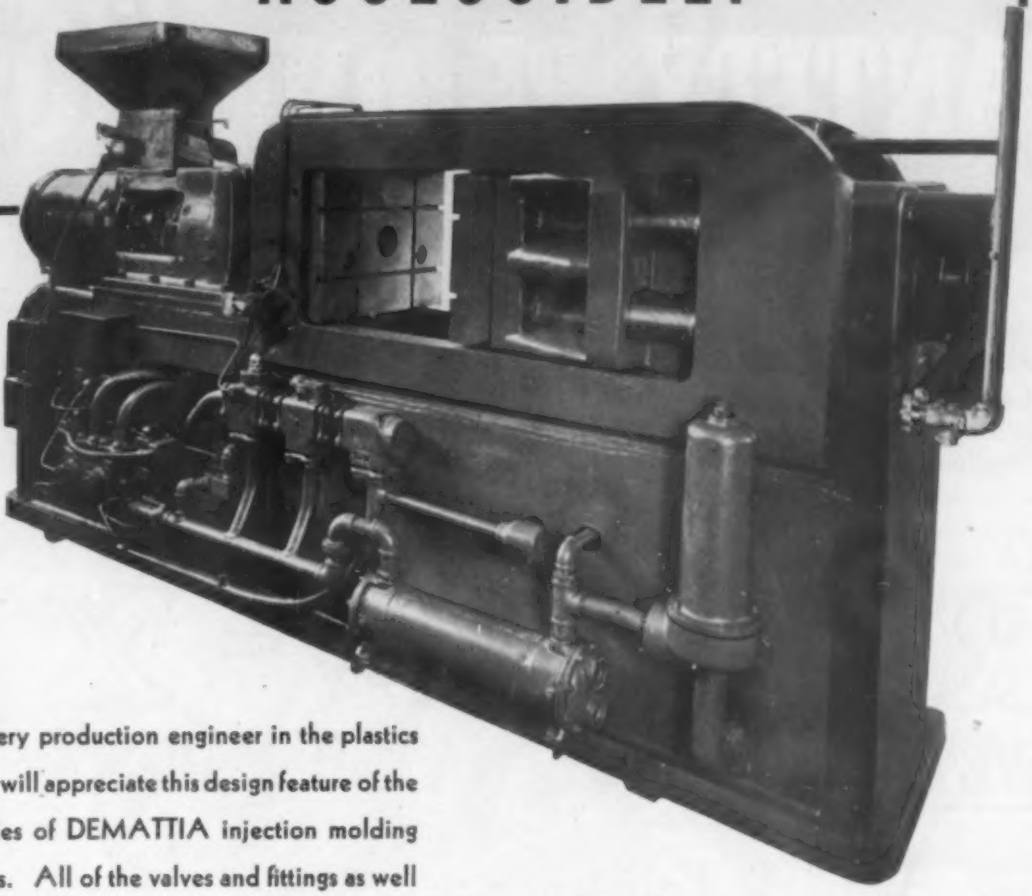

Every production engineer in the plastics industry will appreciate this design feature of the new series of DEMATTIA injection molding machines. All of the valves and fittings as well as the oil cooler and strainer of this versatile hydraulic press are mounted on the outside for quick, easy accessibility. Countless hours of maintenance time are saved by this thoughtful engineering detail.

It is one of the many reasons why the new DEMATTIA injection molding press is rapidly becoming the standout for performance in the plastics industry. As you can see, every cubic inch of this machine is compactly constructed yet there is no crowding or hiding key working parts.

Exclusive DEMATTIA *Features**

1. Actual die-clamping pressure over 400 tons.
2. Complete injection time two seconds.
3. Solid plate frame.
4. Plasticizing capacity: over 130 lbs. per hour.
5. Patented rolling action toggles non-wearing.
6. One piece welded steel base.
7. Injection pressures controlled to 30,000 lbs.
8. Hydraulic adjustment for die changes.
9. Valves, fittings, etc., mounted outside for accessibility.
10. Compact, saves space—only 38 in. by 12 ft.
11. Net weight 16,000 lbs. approximately.

* Above specifications refer to 12-ounce machine.

DEMATTIA *Machine and Tool Co.*

CLIFTON, NEW JERSEY

New York Office — 50 Church Street
Cable Address: BROMACH, N. Y.

The new 16 ounce H-P-M injection molding machine, displayed at the recent Detroit and New York plastics expositions, incorporated many new, outstanding production features, some of which are reviewed below.

The H-P-M straight line hydraulic mold clamp provides for accurate mold alignment, rapid die change-over, positive overload protection and many other features. The newly designed material heating chamber, equipped with electric band heaters, guarantees ample plasticizing capacity with accurate zone heat control.

Powered by the reliable H-P-M oil-hydraulic operating system, each pump, valve, and control is designed and built by H-P-M, thus guaranteeing undivided responsibility to the user.

H-P-M also builds 4 and 9 ounce capacity injection units for high speed production of smaller parts. All sizes of machines are being built in stock quantities. Write today, stating your requirements.

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HPM

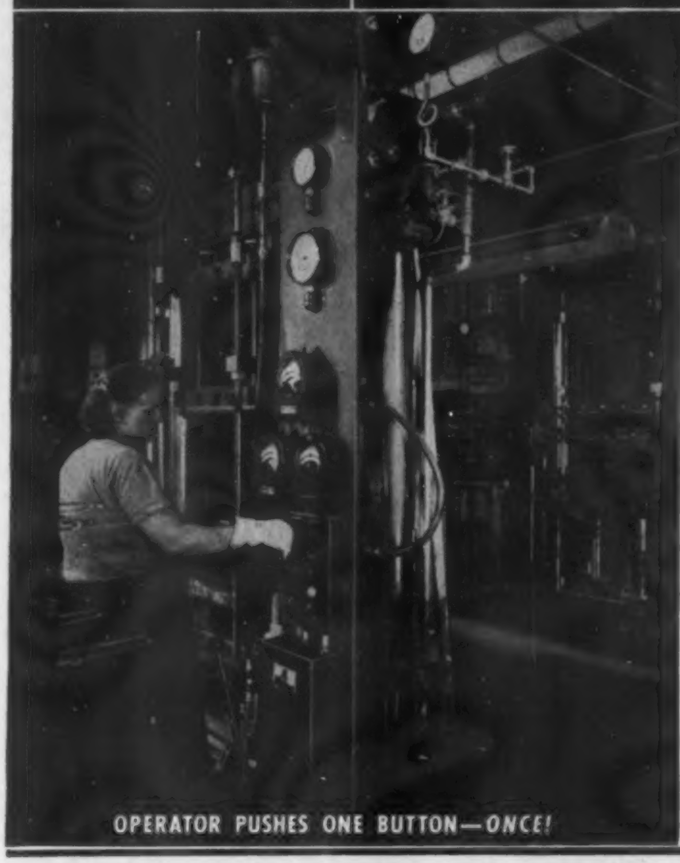
All-Hydraulic Plastics
MOLDING PRESSES

REVOLUTIONIZING PRODUCTION WITH HYDRAULICS SINCE 1877

CLEANING THE MOLD

SETTING PREFORMS

Blow Out Mold... Place Preforms... Push "Start" Button --that's all!



OPERATOR PUSHES ONE BUTTON—*ONCE!*

This self-contained Elmes press goes through closing, breathing, and curing stages—then opens . . . *all* automatically.

Variable travel, working pressures, and time intervals, *plus* instant response to sensitive control, mean high output—*low* costs. An excellent press for deep molds with thin sections. Model 6622.

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ELMES ENGINEERING WORKS
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Also Manufactured in Canada

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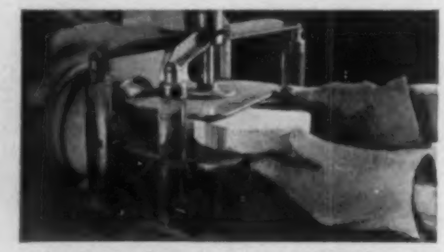
Try the Easy touch for better results in Plastics!

It adds up very simply. Cut the molding pressures way down, and your piece naturally comes out better in every way—stronger, more thoroughly cured, possessing better finish, more uniform density and a higher effectiveness of properties. It will have minimized internal stress and no weld lines. And your mold will give much longer service before showing wear.

How to do it? Heatronics is the answer—radiofrequency pre-heating of plastic pre-forms—a molding technique that permits lower molding pressures by increasing the plasticity and ease of flow of molding materials.



Plastic Pre-form in Heatronic Applicator

The only catch is that Heatronic equipment isn't easily acquired even now—nor is experience in its use picked up overnight. Generally, that is. *But it's different at Kurz-Kasch.* We pioneered in applying Heatronics to plastics. Our Heatronics installation—and our knowledge of its use—balances our extensive custom molding facilities.

Is there something you'd like to know about Heatronics applied to compression or transfer molding? Just ask for a Kurz-Kasch engineer.

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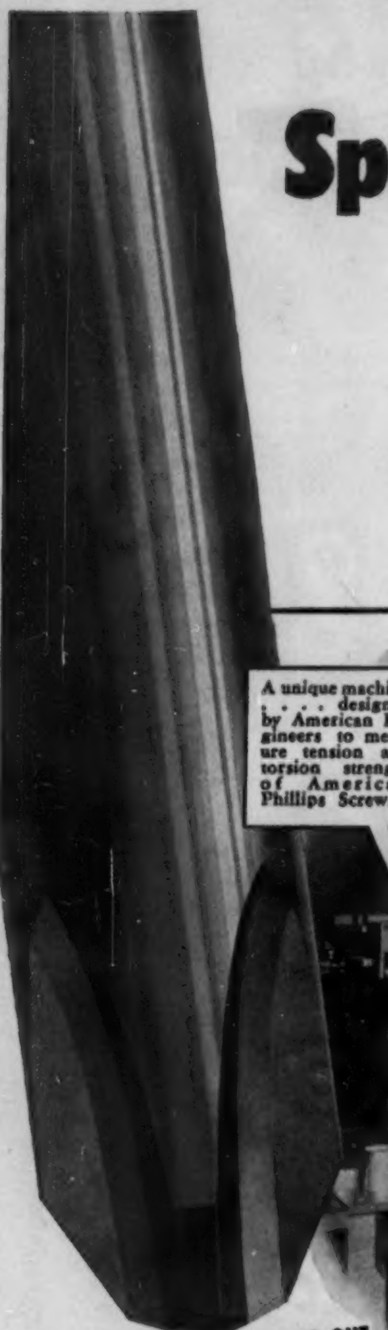

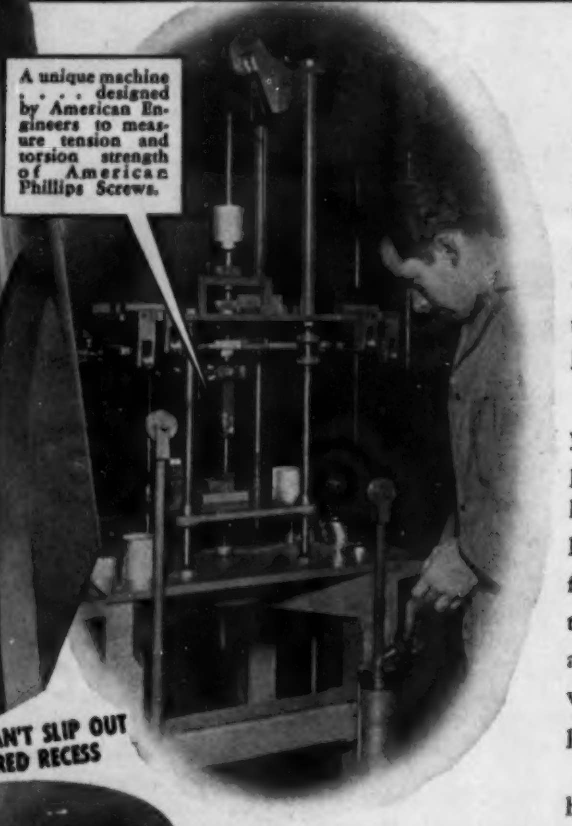

Make American's Engineering Research Laboratory your own "*Information Center*" on any fastening problem. Find out, according to your own job-requirements, what combination of type, size, head, metal, and finish will give you the American Phillips Screw that will do your job at highest speed, at lowest cost, with most lasting satisfaction.

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ALL METALS: Steel, Brass, Commercial Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

NEW 1/2" DRILL
Model 7016 includes an auxiliary handle (shown in operator's left hand) that can be instantly located in any position—it revolves around the nose of the tool.
FASTER PRODUCTION
Here's big power and accuracy for heavy duty, continuous-production drilling—yet this new ARO Model 7016 Air Drill is 40% lighter in weight than other drills of same capacity!
This big difference in weight makes the ARO ½" Drill easier to handle and greatly reduces operator fatigue. Geared for the correct speed-and-power combination in relation to its capacity—providing a capable, stall-proof answer to all jobs of drilling, reaming and countersinking.
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Baldwin presses can give you the answers. They speed output, boost quality and cut costs on a variety of products from water bottle stoppers to electric meter parts, battery boxes to clock cases, compacts to shuffle-board discs. A new development of great promise is "Hy-speed" plunger molding, which substantially reduces mold costs, and multiplies output.

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The Vertical Compression Unit

Accommodates molds with stationary halves of varying thicknesses. The stationary and moving platens, the top cylinder, toggle mechanism and tension rods are adjustable as a unit up and down three inches from a pre-determined center line. Adjustable clamping mechanism provides for molds with thicknesses varying from 8 to 26 inches.

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The maximum deflection of the steel moving and stationary platens is less than .0015 inch under injection pressure of 23,000 pounds per square inch on the material.

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At no time is the linkage of the hydraulically operated toggle system fully extended. Permits rapid opening and closing with a gentle cushioning effect as the faces of the mold come together.

Compression Ram

May be used for the injection-compression molding method, follow-up compression on straight injection molding, transfer molding, actuating gate shearing pins, unscrewing and knock-out devices, and so forth.

A
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O'VF" MOLDING MACHINE

This versatile machine molds by injection, compression or transfer—or in combination. It gives you these seven distinct advantages:

1—Faster, improved techniques for molding large castings of heavy cross-sections

2—Substantial savings in finishing costs

3—Improved quality of molding

4—Closer molding tolerances

5—Elimination of shrinkage and voids on heavy sections

6—Injection molding of large projected areas

7—Flexibility in mold design

Far-Reaching Results

A vertical unit in combination with a horizontal injection unit, and a compression ram in the vertical unit which operates up through, but independently of, the stationary die platen, combine to give this machine a versatility which obtains results far beyond the scope of conventional machines.

Write for the complete story.

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Improved **PAPER MACHINERY CORPORATION**

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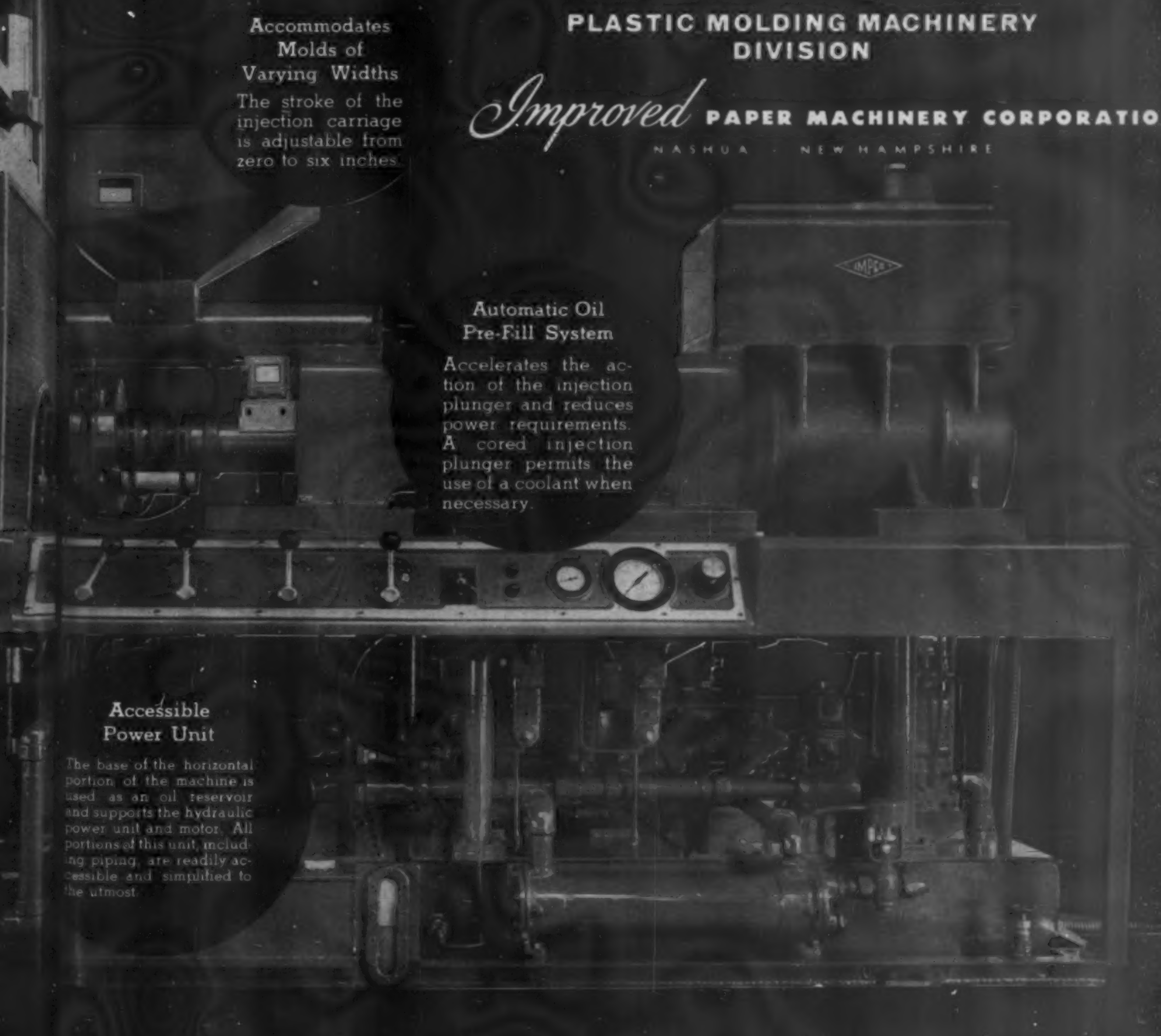
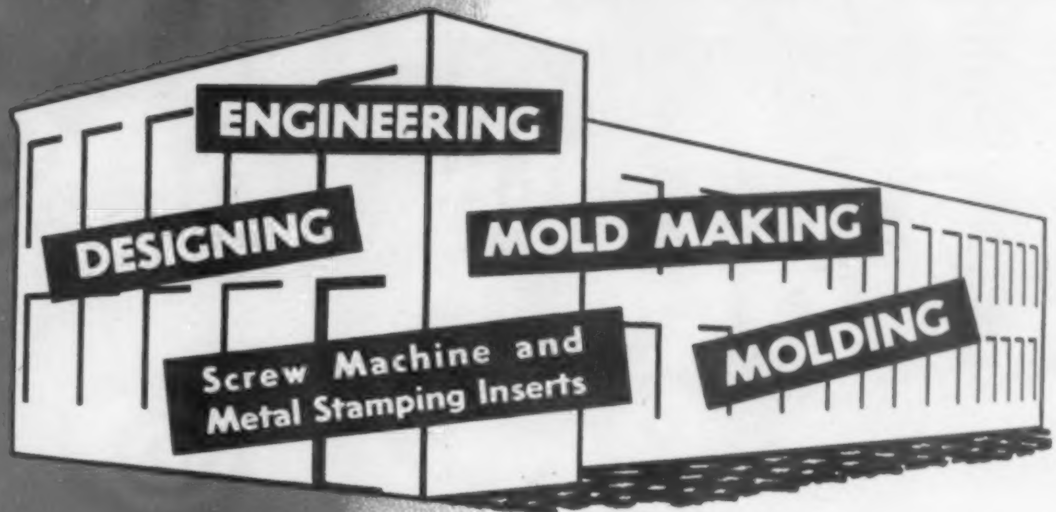


UNDER ONE ROOF...



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★ *If you've got a metal-plastics job that's worrying you, we invite you to talk it over with us. The probabilities are that we can get together on some thoughts that may help you. We don't know all the answers, but some of our friends and customers tell us we've come up with some pretty good ideas for them. Call or write us today.*

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Why ... nplete Service

Partial view of tool room at Minnesota Plastics Corp.

Good tooling is the basis of good molding.
Complete facilities from product design to
finished article are always available at –

"Your Plastics Department"

MINNESOTA PLASTICS CORP.

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MINCOR
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This Gallery of "Rogues" is a *Corking* Example of Consolidated's Ability to Inject Character into Plastic Molding

These colorful and highly polished "Men of Distinction" are stoppers! Corks, cemented over the studded extension of each caricature, qualify the subjects as protectors for opened bottles of catsup, vinegar, beverages, etc.

Toni-Corks, injection molded of Styrene material, do, thru careful mold design, faithfully portray the individual and varied facial expressions created by the sculptor.

The assignment, though one of simple molding procedure, serves to highlight Consolidated's skill at producing quality . . . in quantity. Our know-how with plastic materials, mold construction, and molding processes — stands ready to custom-serve product designers, and manufacturers. Inquiries invited!

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INJECTION molding
TRANSFER molding

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Plastics

makes a sweeping change

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Elmer E. Mills Corporation's injection molding and extrusion specialists can give your product similarly revitalized appeals. Investigate our service today without obligation.

Write on your letterhead for the new Injection Molded and Extruded Plastics catalogue. Or, for detailed information about MILLS-PLASTIC* pipe, tubing and fittings, write for circulars containing data and illustrations.

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We invite your inquiry for details, samples and prices.

Swedlow PLASTICS CO.

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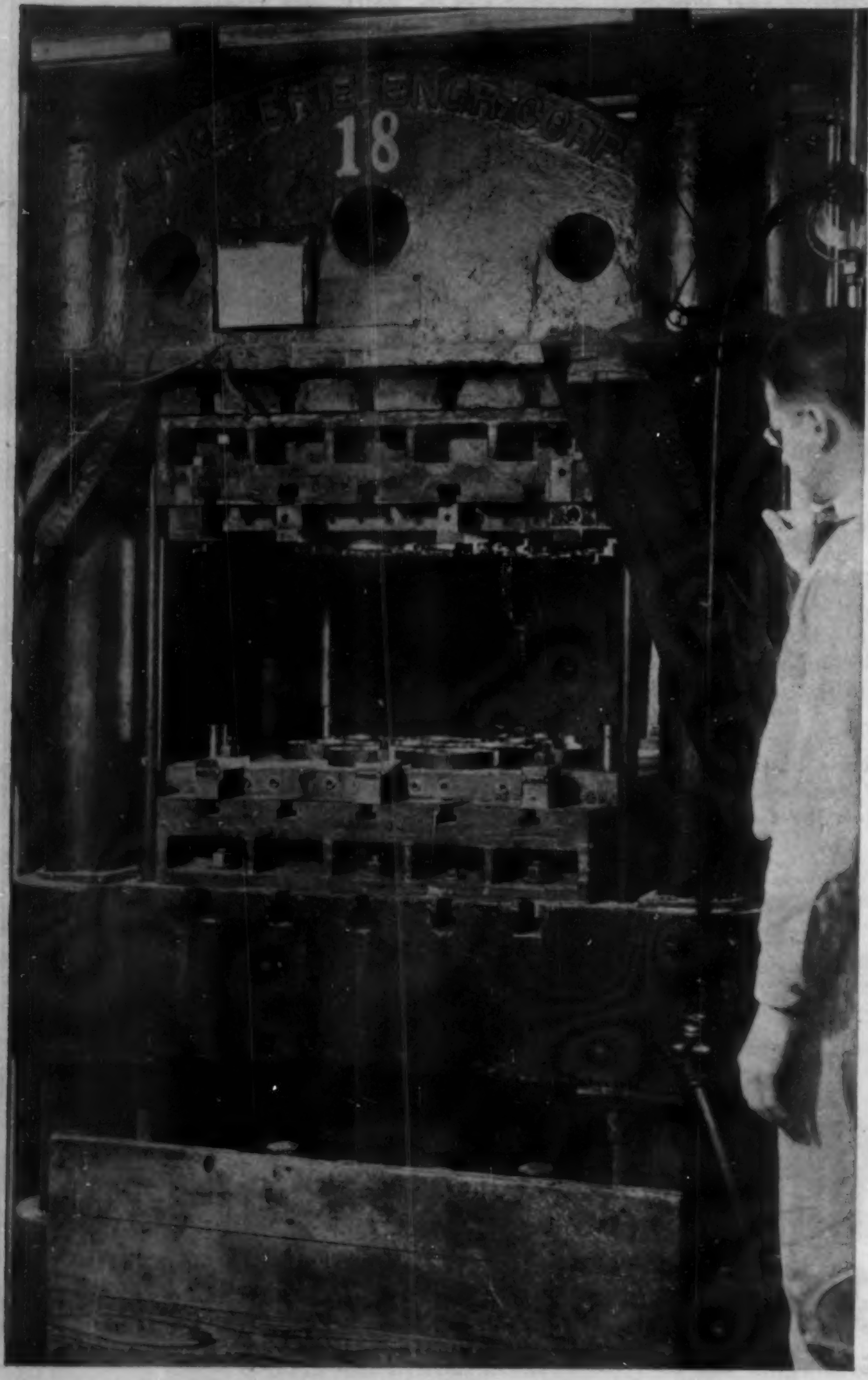
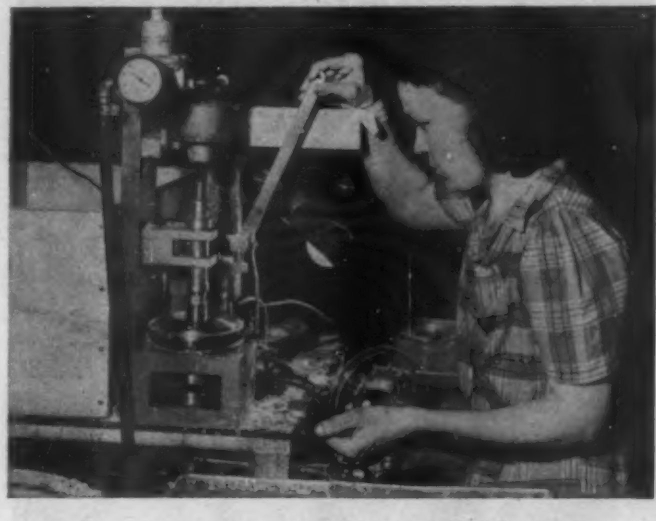
Molding Buick* Clock Dials

Pictures tell the story of molding and finishing methods—a dozen clock dials at a time are turned out on this 450-ton Lake Erie Hydraulic Press.

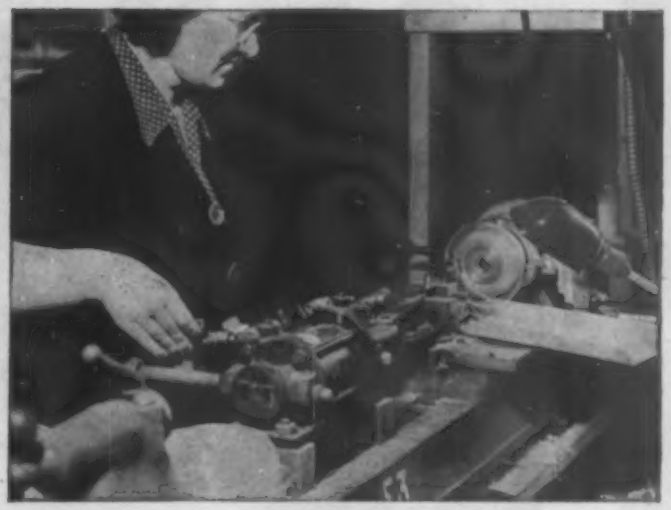


1 Above shows operator filling mold in the Lake Erie Press with a special cup-type spreader developed at Norton Laboratories. When the cup is lifted, it discharges the plastic compound and distributes it uniformly in the mold cavity. The accumulator operated Lake Erie Hydraulic Press at left is closed with city water pressure. At 0.15 min. the mold is given a 2600 lb./sq. in. high pressure squeeze. At 1.00 min. the high pressure is applied. At 1.50 min. the steam is turned off and the drip opened. Water is turned on at 1.75 min. and the mold is cooled for 2¼ min. before opening. This 450-ton hydraulic press has been in service for over ten years. Aside from normal servicing, the records at Norton Laboratories show that this Lake Erie Press has required little or no maintenance.

at Norton Laboratories . . .

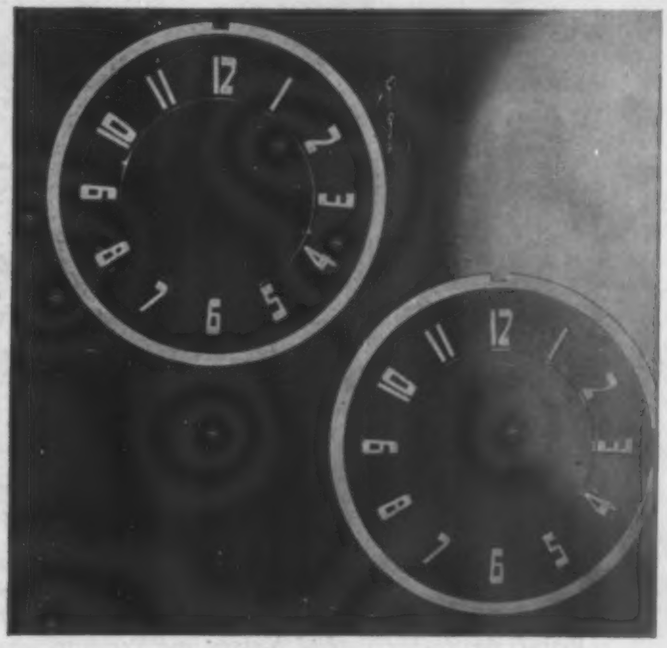


2 Removing outside flash from clock dials is speedily performed on this semi-automatic vertical trimming machine developed by Norton Laboratories.



3 The inside core of the dials is quickly removed with this automatic lathe which has a pneumatically operated feed, another Norton development.

4 Painting dials is the last step before final inspection and packing. The turntable rotates the clock dial while the outside stripe is being applied.



******Finished dials. The clocks on which dials are used are manufactured by the George W. Borg Corporation for the Buick Motor Division of General Motors Corporation.*

● *Lake Erie supplies a wide range of standard and special presses—self-contained and accumulator operated—to plastic molders. These well-known presses are illustrated and described in Bulletin 544 just off the press. Write for a copy of this new Bulletin or consult Lake Erie about your hydraulic press requirements. No obligation, of course.*

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ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

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ENGINEERING CORPORATION
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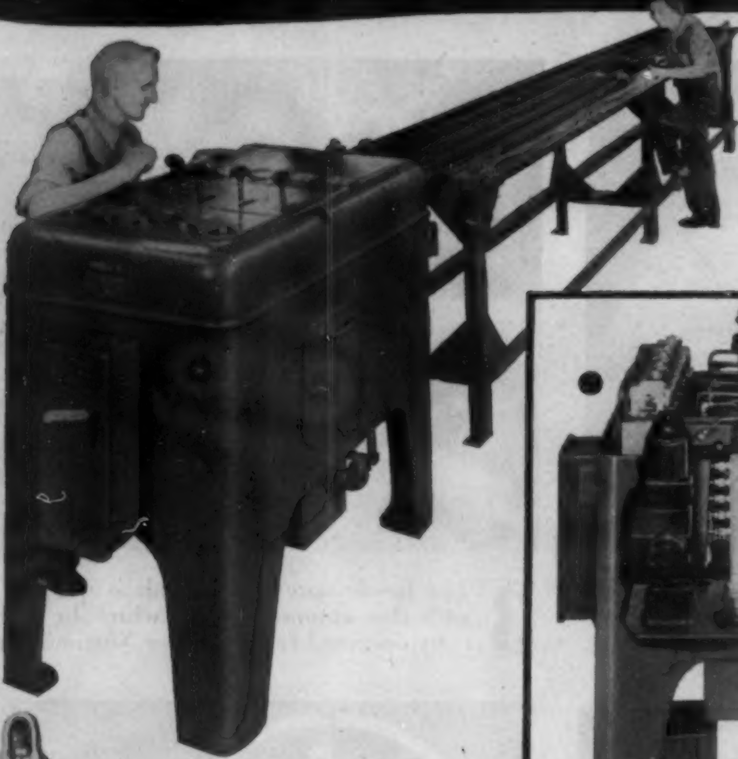
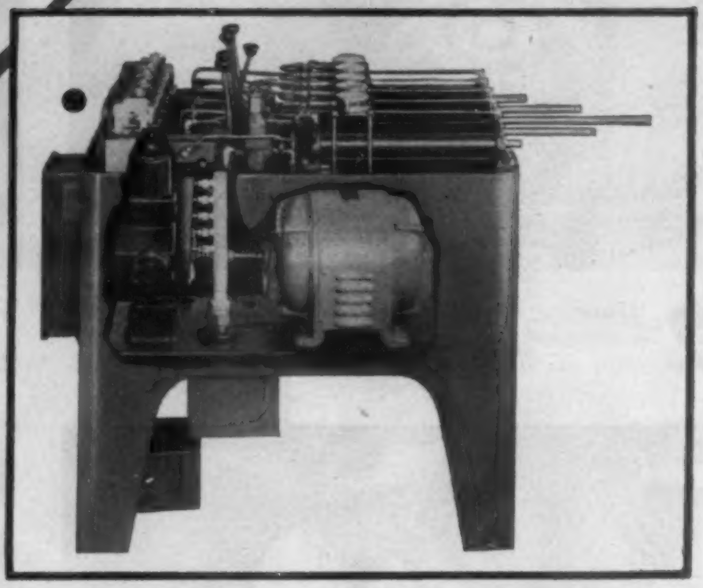
Offices in Principal Cities and Foreign Countries

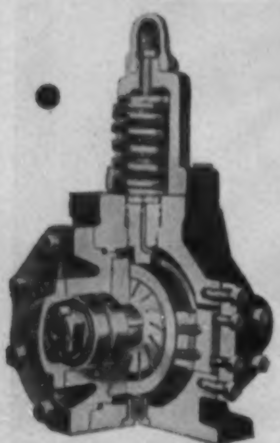
Leading manufacturer of hydraulic presses—all sizes and types—plastic molding... metal working... processing... rubber vulcanizing... stereotyping... special purpose.

Another HYDRAULIC ACHIEVEMENT . . .





Courtesy
Parker Appliance Company
Cleveland, Ohio



with Racine *Oil Hydraulic* variable volume pumps

The use of a Racine Variable Volume Pump and five Racine Four-Way Valves in the Parker Hydraulic Cable Stretcher is but one of the many applications where Racine Pumps and Valves are employed for power movements. Here is another demonstration of the versatility of hydraulic force as developed by Racine Pumps.

In this machine, one Racine Pump provides a tension range from 100 to 3000 lbs. Five different "stretching tests" can be conducted at one time — each cycle of operation completely automatic.

If you have a power movement — holding, lifting, pressing, clamping, feeding, bending or embossing, a Racine Variable Volume oil hydraulic Pump can do the job for you directly, smoothly and at low cost. Capacities 0 to 30 G.P.M. Pressures 50 to 1000 lbs. p.s.i. Write for our latest Catalog P-10-C on Racine Pumps, Valves and Pressure Boosters. At the same time, outline your hydraulic problems. Our staff of factory and field engineers will cooperate with you, without cost or obligation.

RACINE HYDRAULIC FOUR-WAY VALVES — A complete line with either manual, mechanical or electrical control devices. Sizes 3/8" to 1½" I.P.S.

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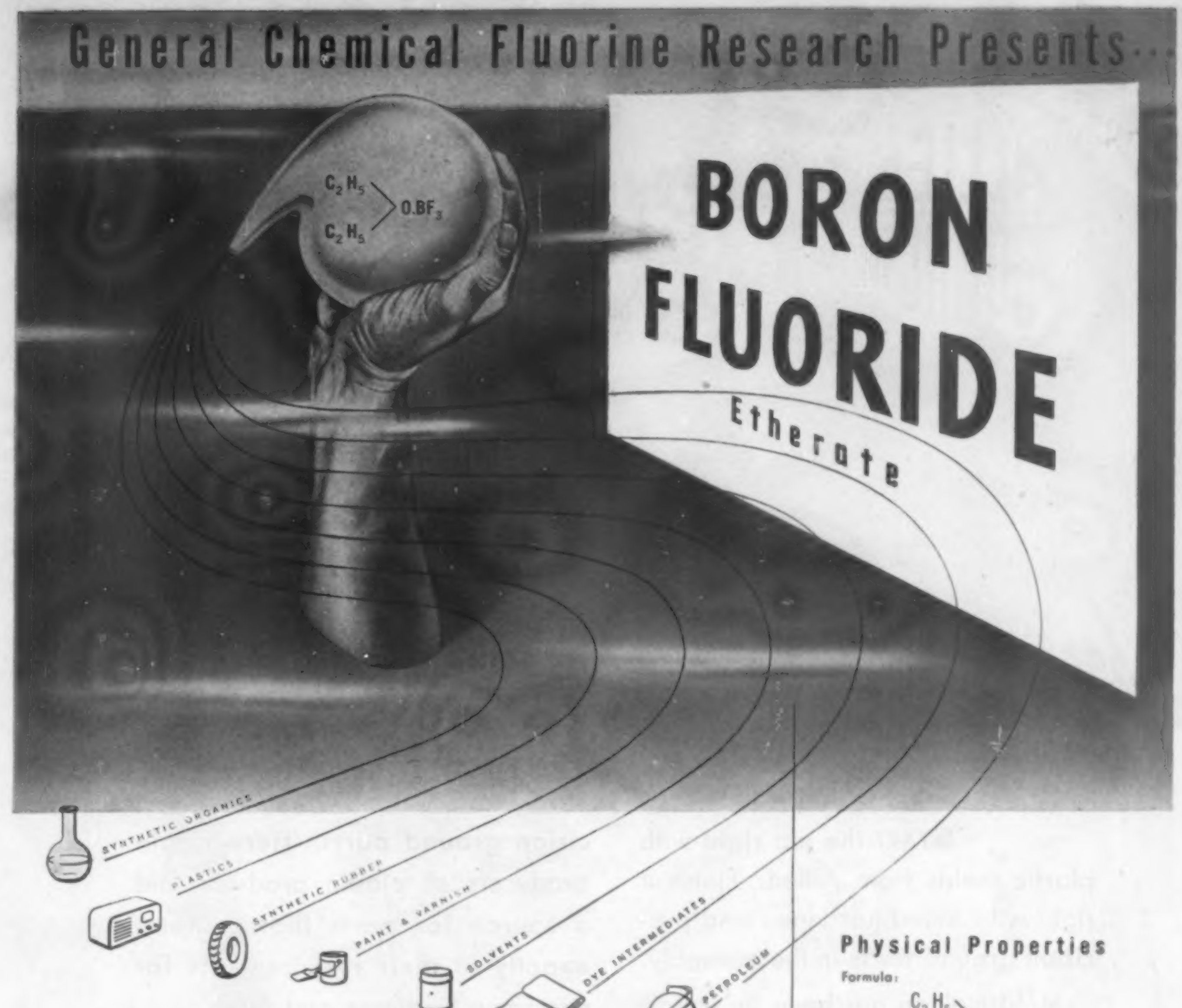

THE CATALYST TO CHART NEW COURSES FOR AMERICAN INDUSTRY

Boron Fluoride Etherate . . . valuable catalytic chemical of wide ranging potentialities for American Industry!

This new liquid fluorine compound has a multitude of uses. Technical literature—filling volumes—contains extensive data on the reactions catalyzed by BF_3 as well as by its complexes with other organic molecules. Repeated reference is made to its superiority to other catalysts since reactions are moderated and fewer undesirable by-products result.

Outlined at right are some of the principal applications for BF_3 as a catalyst. Perhaps they indicate ways in which you can utilize a chemical of these characteristics in your development or production program.

Boron Fluoride Etherate is commercially available in drums. For full information, contact General Chemical Company, Fluorine Division, 40 Rector Street, New York 6, N. Y. When writing, if you outline your proposed application for this new catalyst, the technical experts of our Fluorine Division can work with you toward an early solution of your problem.

Physical Properties

Formula:

$$\begin{matrix}C_2H_5\\C_2H_5\end{matrix}\Big\rangle O.BF_3$$

Mol. Wt.	141.9
Melting Pt.	Less than —60°C
Boiling Pt.	125°C
Spec. Gr.	1.14 at 25°C
%BF_3	47.8% min.

Some of the Principal Reactions Catalyzed by BF_3

1. Polymerization of unsaturated compounds such as olefins, diolefins, vinyl ethers, fatty oils, and terpenes. The products may be solid polymers useful as plastics or liquids as in the bodying of drying oils for paints and varnishes.

2. Condensation of aromatic nuclei with olefins and diolefins, paraffins, and olefins, and aromatic nuclei or olefins with acids.

3. As a cyclizing agent for rubber.

4. As an esterification catalyst.

5. As a catalyst in the synthesis of aliphatic acids from alcohols and carbon monoxide.

6. As a promoter and dehydrating agent in the sulfonation and nitration of aromatic compounds.

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BASIC CHEMICALS
GENERAL CHEMICAL COMPANY
FOR AMERICAN INDUSTRY

START the job right with plastic molds from Allied. Finish it right with Allied hardened and precision ground parts in the assembly.

Mold-making has been an important phase of Allied's operations for many years. Today, leading plastics fabricators throughout the country use molds made by this company . . . knowing that their specifications for accuracy of form and fine service finish are met exactly.

One of the four large Allied plants is devoted exclusively to the manufacture of hardened and precision ground parts. Here again producers of plastic products find a source for parts that conform exactly to their requirements for accuracy, hardness and finish.

Let us show you how Allied can serve you in *two* ways. Quotations on your molds or parts will be submitted promptly.

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SPECIAL COLD FORGED PARTS • STANDARD CAP SCREWS • HARDENED AND PRECISION GROUND PARTS • SHEET METAL DIES FROM THE LARGEST TO THE SMALLEST • JIGS • FIXTURES • STEAM-HEATED PLASTIC MOLDS • SPECIAL PRODUCTION TOOLS • R-B INTERCHANGEABLE PUNCHES AND DIES • DIE MAKERS' SUPPLIES

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Pure Phenolic
Pure Phenolic
Pure Phenolic
Pure Phenolic
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Solid (Powdered)
Liquid
ABRASIVE PRODUCTS
Grinding Wheels
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8121, 3014
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Abrasive Discs
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Solid (Powdered)
Solid (Powdered)
Oil Modified Phenolic (Powdered)
FRICTION MATERIALS
Brake Linings and Clutch Facings
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5477F, 5475
6106, 7200, 9815
Oil Soluble (Lump)
Oil Modified (70%—85% solids)
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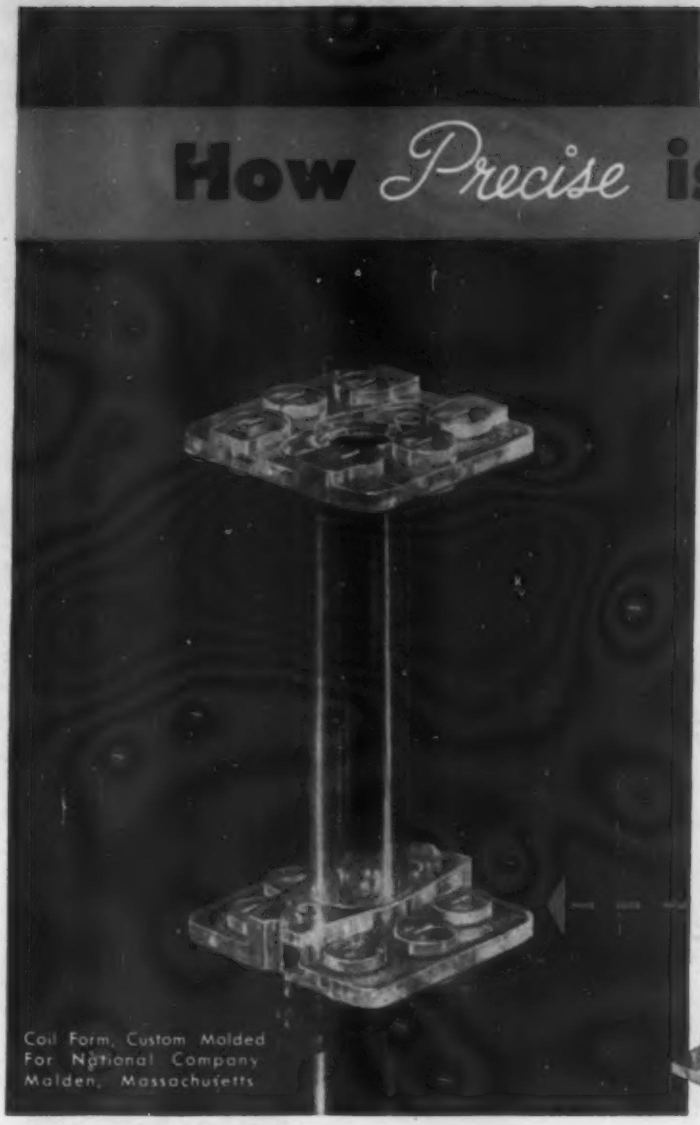
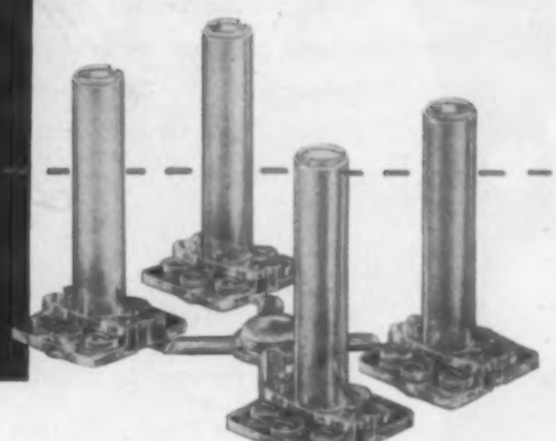
INTERESTED? SEND FOR NEW FREE BULLETIN! Write us for Bulletin 46-1 today. It contains several recommended uses of these resins.
VARCUM CHEMICAL CORPORATION
NIAGARA FALLS, NEW YORK

How *Precise* is Precision?



Coil Form, Custom Molded For National Company Malden, Massachusetts

ERIE RESISTOR CUSTOM MOLDED *Plastics* REVISE PREVIOUS CONCEPTS



THIS custom injection molded coil form is made in two interdependent parts, which must be extremely accurate. A lug on the top fits into a slot in the recessed square shoulder of the column, to make a snug, tight fit. The overall dimensions of the post and one base, molded as a unit, is only 2.510" in height, with tolerances to be maintained of +.000", −.005". Two holes in base have a radius of .141", +.004", −.000". All other dimensions are held to equally close tolerances.

You may not be in the market for coil forms. But a container, a housing, any component or moving part for your product may have to be made with just as great precision, in dimensions, insulation, abrasion or other qualities.

If your specifications can be met in the whole versatile range of plastic materials and plastic molding methods, Erie Resistor can make it. Don't be discouraged, even if some other manufacturer has said it couldn't be done. A lot of our jobs have been "impossible" until the irrefutable evidence of the completed product was presented to the delighted customer.

Plastics Division

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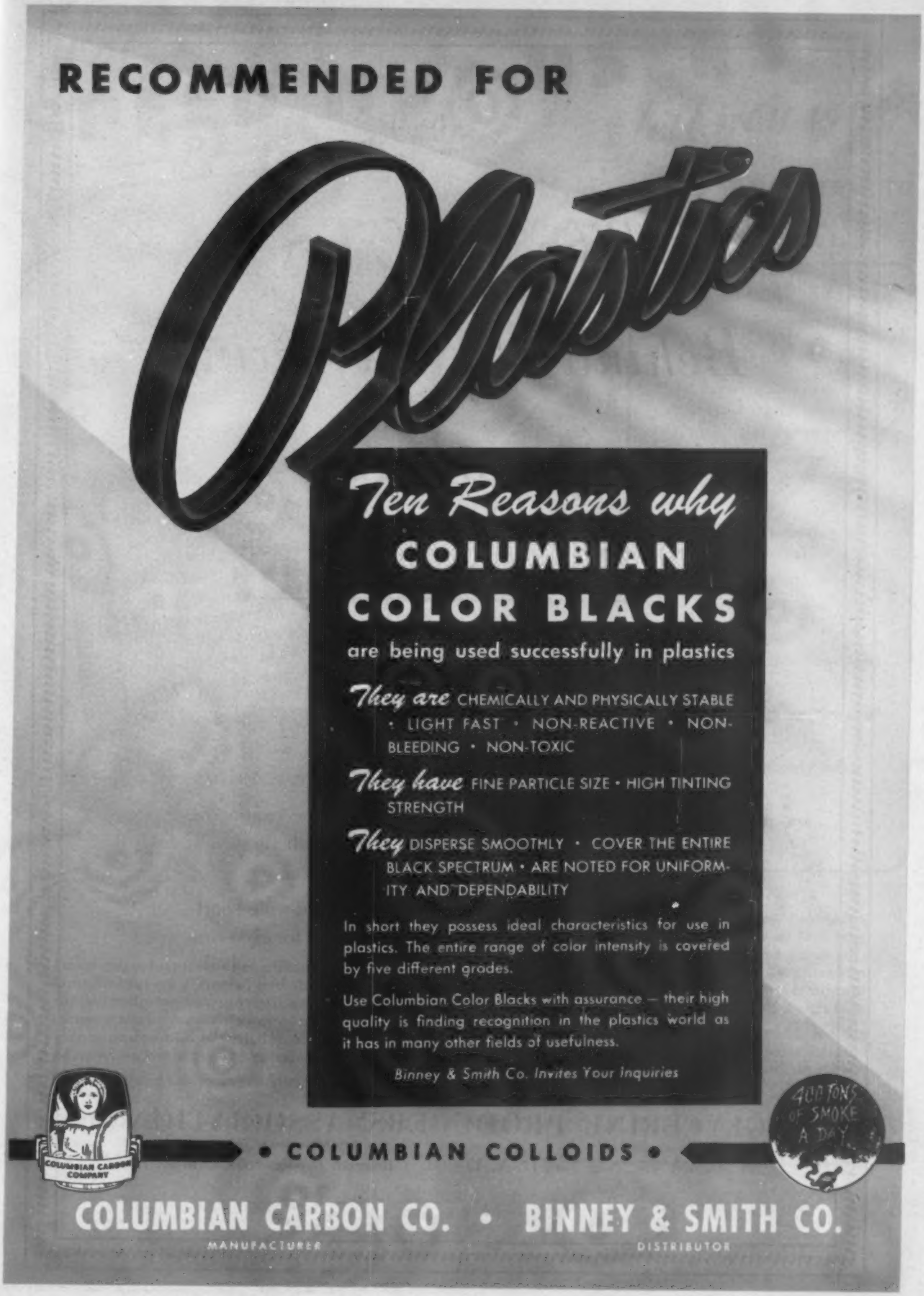
PAPER
"at work" in many* new ways!
*In telephones, for instance
CENTRAL 1100


RECOMMENDED FOR
Plastics
Ten Reasons why
COLUMBIAN
COLOR BLACKS
are being used successfully in plastics
They are CHEMICALLY AND PHYSICALLY STABLE · LIGHT FAST · NON-REACTIVE · NON-BLEEDING · NON-TOXIC
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In short they possess ideal characteristics for use in plastics. The entire range of color intensity is covered by five different grades.
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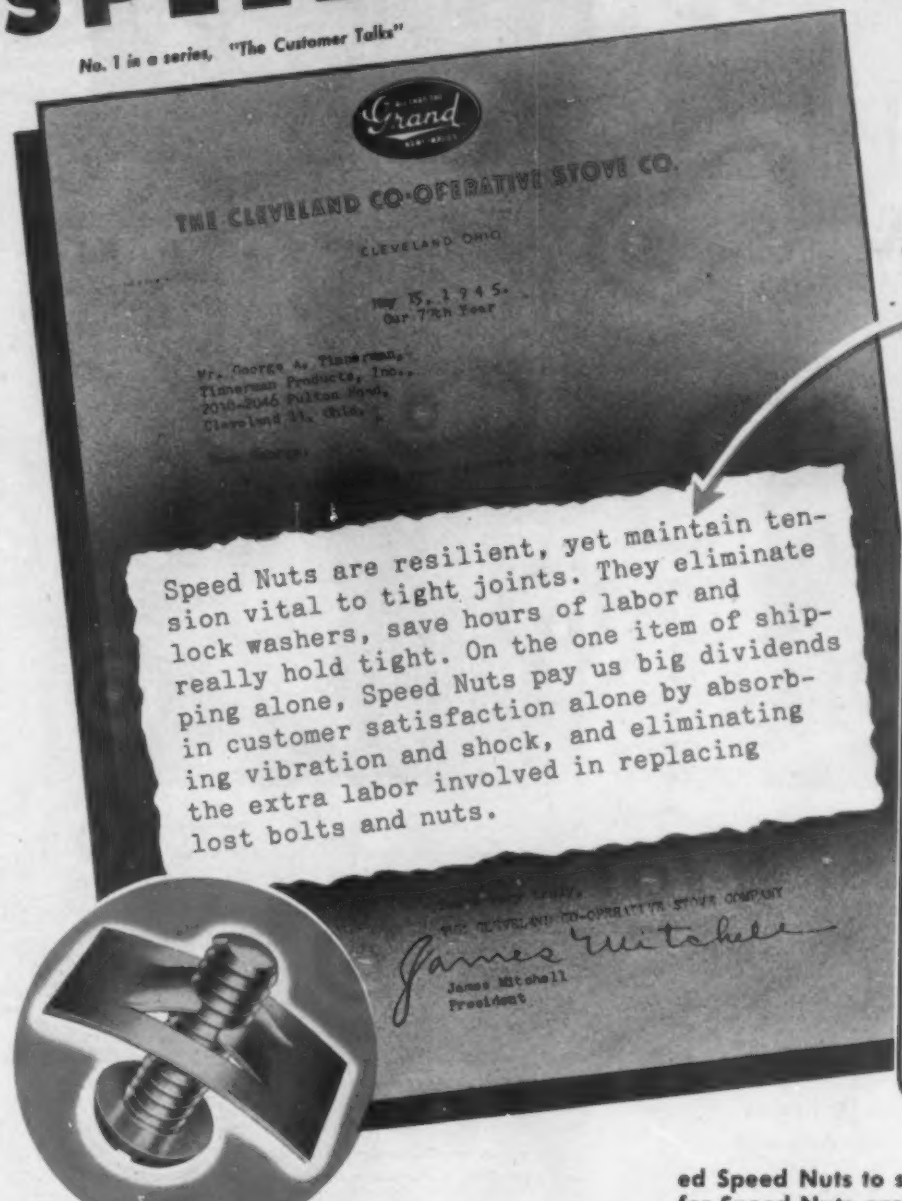

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THE CLEVELAND CO-OPERATIVE STOVE CO.
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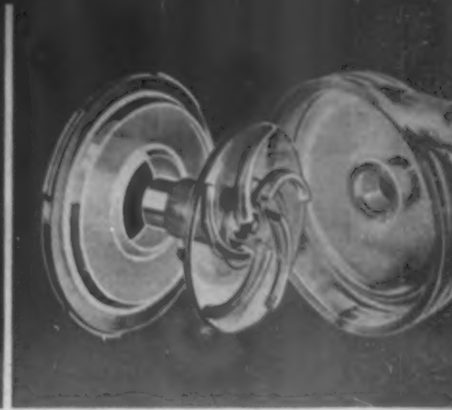
Speed Nuts are resilient, yet maintain tension vital to tight joints. They eliminate lock washers, save hours of labor and really hold tight. On the one item of shipping alone, Speed Nuts pay us big dividends in customer satisfaction alone by absorbing vibration and shock, and eliminating the extra labor involved in replacing lost bolts and nuts.
James Mitchell
President


COLORFUL NEW PLASTICS MAKE BEDROOMS
Wake Up!
TIME
Coronet
Once again Emeloid teams beauty with practicality to accentuate the modern plastic trend—this time in attractive appointments for the bedroom. Latest products of Emeloid's new molding technique are a tie rack and magazine rack. Washable, durable and economical, they demonstrate anew Emeloid's continued mastery of molding to popular public approval—for greater consumer sales!
A. Tie Rack B. Magazine Rack C. Festoon Holders D. Luminous Curtain Pull E. Wastebasket F. Curtain Tie Backs G. Picture Frame H. Compact I. Utility Box J. Powder Box K. Luminous Cross.
Items illustrated are sold through chain and department stores.
25 YEARS OF
"PROGRESS IN PLASTICS"
Special articles molded for the trade
The Emeloid Co., Inc.
ARLINGTON, NEW JERSEY


Treasures in Plastics
CRUVER
WASHABLE
PLASTIC PLAYING
CARDS

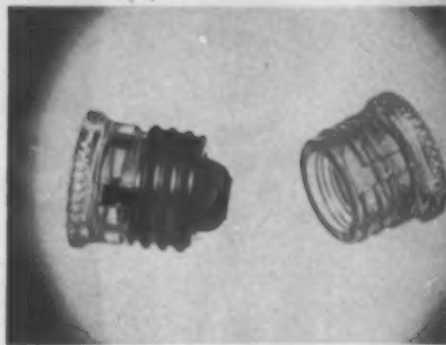
Food Mixer Bowls



Glass Pump Parts

GLASS

that gives your product better performance and added sales appeal . . .



Fuse Plugs

Christmas Tree Ornaments

If your product needs a "dressing-up"—the sparkle and clean appearance that attracts the buyer's eye—if at the same time its performance can be improved by using the many valuable properties of glass, by all means contact Corning Engineers.

Consider this unique combination of useful qualities—corrosion resistance, transparency, heat resistance, permanence of color, finish and dimensions. Many manufacturers are taking advantage of the properties of glass in developing new products and in redesigning. You, too, may be able to use glass to advantage.

RESEARCH IN GLASS

Corning has on record more than fifty thousand different glass formulae—each providing a balance of properties which meet specific application requirements. These glasses have valuable properties throughout a wide range of values and in many combinations. Corning Engineers can recommend the glass that will best answer your requirements—or, if necessary, develop a new glass.

CORRECT GLASS DESIGN

Detailed drawings of thousands of different glass products are on file in the Product Engineering Department file at Corning. The vast knowledge and experience accumulated over a period of years in developing these products is the basis upon which recommendations will be made for your specific needs.

PRODUCTION FACILITIES

At Corning you are assured of economical production of quality glassware in almost any quantity desired by the versatile production facilities and "know-how" and experience of the men engaged in manufacturing. Glass can be pressed, blown, or drawn either by hand methods for small quantities or by high speed automatic machinery. Carefully controlled finishing operations secure the necessary precision tolerances.

In many products the use of glass has lowered manufacturing costs, speeded up production and stimulated sales. Corning Production Engineers will be glad to show you how glass can be incorporated in the design of a new product or in an improved design of your present products. Write to Industrial Sales Department MP-7.

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Vacuum Bottle and Glass Filler

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CORNING means Research in Glass

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C/A CELLULOSE ACETATE
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Plastics
Beautifully formed from
NIXON C/N
Shoe Form Company takes a straight piece of NIXON C/N (Cellulose Nitrate) tubing and, almost magically, forms it into a glamourous eye-appealing shape, available in three different tones. Just another use for this versatile plastic material. In addition to tubing, NIXON C/N is available in sheets and rods. Find out more about NIXON C/N and how you can use it in your own production.
(Left) Shoe Form Company's #W17 Tip-Toe Form in Glamour-Glo finish. Available also in Neutra-Tone and Transparent.

Keeping abreast of Plastics Progress . .

Long before the manufacture of plastics materials and products attained industry proportions, Timken Tapered Roller Bearings were used in most of the standard types of equipment that since have been adapted to plastics production—particularly machine tools, including lathes, grinders, drilling machines, boring machines, milling machines, mechanical presses, planers, etc.

The application of Timken Bearings similarly is indicated for new machinery specially designed for plastics production and already they are being used extensively. One of the most important of these new applications is on the roll necks of plastics rolling mills where great accuracy plus radial, thrust and combined load capacity is essential.

Whether you make or use plastics equipment it will pay you to insist on it being Timken Bearing Equipped and to see that the trade-mark "TIMKEN" appears on every bearing that goes into it. The Timken Roller Bearing Company, Canton 6, Ohio.

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

HOW VARIABLE-SPEED INDIVIDUAL ROLL DRIVE MULTIPLIES TESTABILITY IN THIS LABORATORY MILL

Powered by individual 5 HP variable-speed motors (1), each roll (2) of this Farrel-Birmingham 6" x 13" laboratory mill can be run at speeds varying from 25 to 60 RPM. This multiplies the test-making ability of the mill by making possible a wide range of roll friction ratios . . . from even speed to 2.4 to 1.

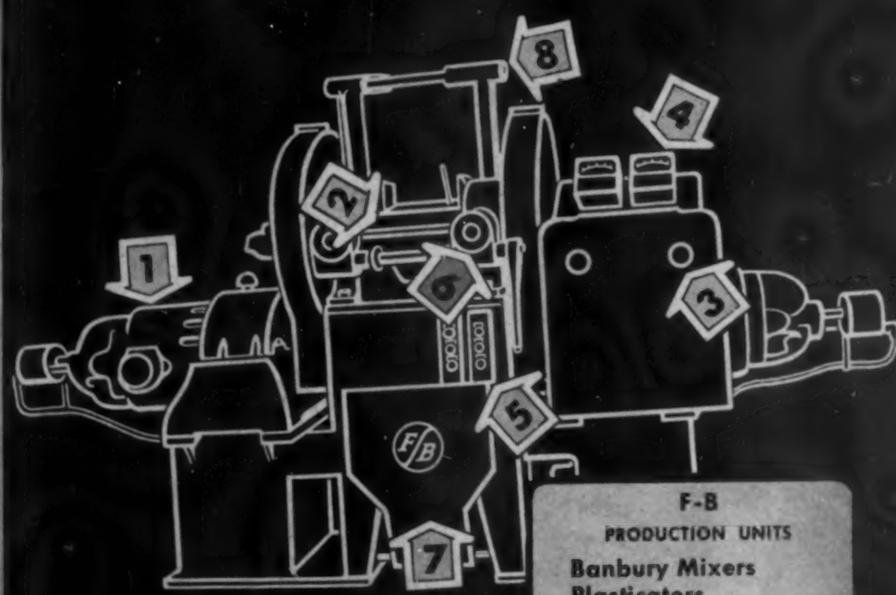
Whatever combination of roll speeds is desired can be obtained simply by manipulating the separate motor speed controls (3) mounted on the front of the mill. Roll RPM is shown on easily visible tacho-generator indicators (4). Each motor also has push button control (5) for start, stop and reverse. Either stop button will stop both motors.

Other details of design include precision ground, hard chilled iron rolls, accurately bored for uniform heating or cooling . . . front roll adjustment by worm, worm wheel and hand rachet (6) . . . and safety throwout which may be operated by both knee action (7) and overhead bars (8) from either side of the mill.

FB-302

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia, Derby and Stonington, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Pittsburgh, Akron, Los Angeles, Tulsa, Houston, Charlotte

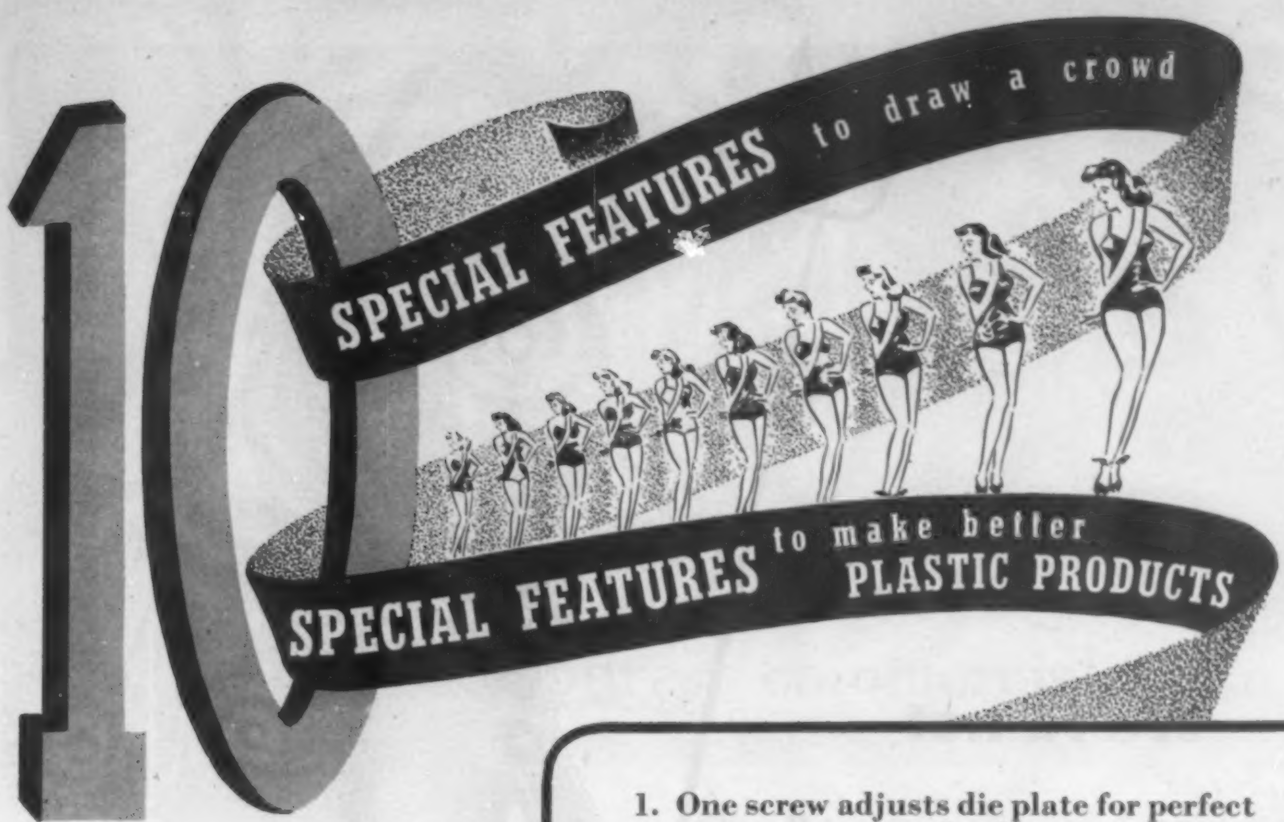


Other sizes and types of laboratory mills are designed and built to suit individual needs. Farrel-Birmingham engineers will be glad to help you select the correct mill for your purpose. Feel free to call on them at any time, without obligation.

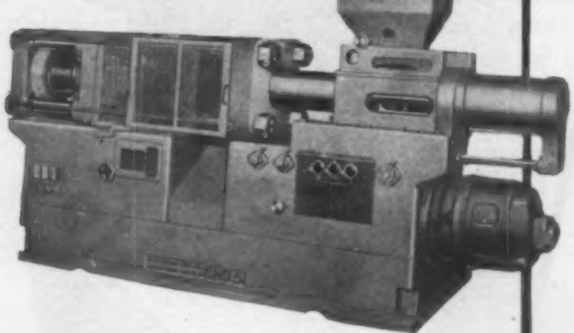
F-B PRODUCTION UNITS

- Banbury Mixers
- Plasticators
- Pelletizers
- Mixing, Grinding, Warming and Sheeting Mills
- Bale Cutters
- Tubing Machines
- Refiners
- Crackers
- Washers
- Calenders
- Hose Machines
- Hydraulic Presses and other equipment for processing rubber and plastic materials.

Farrel-Birmingham



1. One screw adjusts die plate for perfect alignment — no flooding.
2. Equal pressure distributed by "Central-shaft" moveable plate support.
3. Full length pin-support in heavy-duty toggle assembly.
4. Multiple knockout pin system avoids cramping and gate breakage.
5. Stationary head die-plate.
6. Hydraulically controlled mobile head.
7. Easy access to injection nozzle.
8. Operation by master clock and relays. Controls and indicators built in.
9. Pyrometer heat control for accuracy, economy.
10. Two way safety control: both doors must be shut before machine operates.



Yours for the asking: Leominster plastics machinery brochure, listing machinery and equipment to speed and simplify production — give the results in safety, economy, finished work.

LEOMINSTER TOOL CO., Inc.

LEOMINSTER, MASSACHUSETTS

MANUFACTURERS OF MACHINES, TOOLS AND DIES FOR THE PLASTICS INDUSTRY

We're not "Devil-may-care"

... and the devil on the right is proof of *that!* He's composed of a number of different plastic parts made by Continental. He has a plastic gearshift knob for a head. And his horns and tail are plastic handles. In fact, with every part of him goes a plastic success story.

Working with experienced care, our staff of designing and research experts solve "pernickety" product problems. The plastic parts or accessories, themselves, have all those qualities one expects in a plastic . . . lightness, strength, durability, and economy.

Remember, you can always depend on Continental's engineering "know-how". So whenever you think of plastics, be sure to remember Continental.

• • •

Other Continental Products: Metal Containers • Fibre Drums Paper Containers • Paper Cups • Steel Containers Crown Caps and Cork Products • Machinery and Equipment

Tune in "Continental Celebrity Club," every Saturday over coast-to-coast CBS network

CONTINENTAL CAN COMPANY, INC.

PLASTICS DIVISION

HEADQUARTERS: Cambridge, Ohio

Sales Representatives in all Principal Cities

COMPRESSION • INJECTION • EXTRUSION
SHEET FORMING • LAMINATION

Common Sense Assembly Engineering

Cuts Unit Assembly Cost 8¼¢... Greatly Improves Product

BEFORE Enameled steel knob on bracket of old model "Quintuplet" Can Opener cost 4½¢ to 5¢ . . . two large and two small special bracket rivets 1⅔¢ each. On opener, turning handle was soldered to cutter wheel, prevented easy replacement. TOTAL ASSEMBLY COST 11¢.

AFTER Plastic Knob (2½¢) replaced steel knob. Attached with P-K Hex Head Type "Z" Self-tapping Screw, which also serves as locking and locating device, eliminating one large bracket rivet. Improved, detachable crank handle on opener is fastened by two Hex Washer Head Type "Z" screws, making replacement of cutting gear easy. One Hex Head Type "Z" Screw attaches second plastic knob to crank handle. Screws are driven with a power press driver. TOTAL ASSEMBLY COST 2¾¢.

Here's a case where "looks" belie the facts. The new model "Quintuplet" Can Opener made by the Cahil Manufacturing Company *looks* like a costlier assembly job than the old one – but it isn't. It's 8¼¢ cheaper, thanks to common sense assembly engineering and P-K Self-tapping Screws.

By eliminating hand operations and high cost special parts, and by combining the functions of other parts, P-K Assembly Engineers helped this company achieve "an outstanding improvement in the product from the user's standpoint, plus considerable savings in time, labor, and material" according to Mr. J. A. Cahil, President.

Such savings are not uncommon where Parker-Kalon fastenings are used – they often run as high as 30% to 50% through the elimination of needless tapping, bolting, riveting, and inserts.

Can you apply these benefits in your assemblies? In seven out of ten assembly jobs submitted to us, the answer is "Yes". A P-K Assembly Engineer will call and help you find all possible savings – or, mail assembly details for recommendations. Parker-Kalon Corp., 200 Varick Street, New York 14, N. Y.

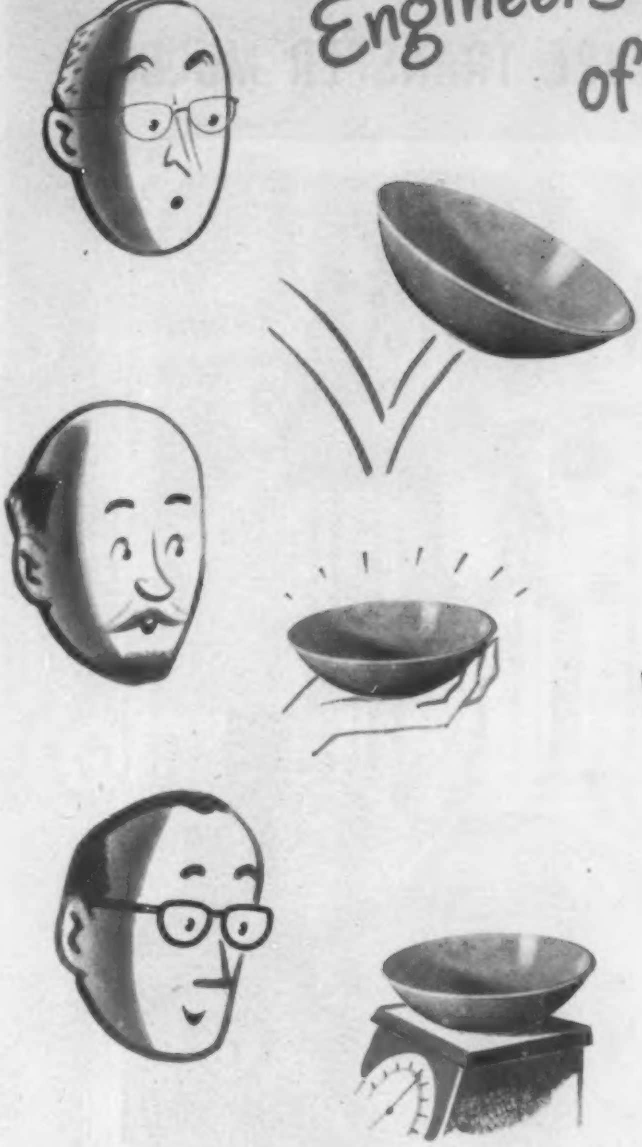
SOLD ONLY THROUGH ACCREDITED P-K DISTRIBUTORS

TYPE "A" · TYPE "Z" · HEX HEAD · **P-K** · TYPE "F" · TYPE "U" · TYPE "Z" PHILLIPS · TYPE "F-Z"

PARKER-KALON SELF-TAPPING SCREWS

FOR EVERY METAL AND PLASTIC ASSEMBLY

Engineers Amazed by Strength of New Bowl!



Lightweight KYS-ITE shows its unusual durability under conditions which would shatter, chip or mar ordinary materials.

This newest KYS-ITE product is another striking example of the amazing combination of properties this plastic offers.

In KYS-ITE you'll find features no other type of material combines—versatility that fits KYS-ITE for the widest variety of products . . . ranging from rollers to valve wheels, pistol grips to cafeteria trays, business machine housings to bowls.

WHY KYS-ITE IS PREFERRED

GREAT STRENGTH WITH LIGHT WEIGHT — Preformed before curing, impact strength up to five times that of ordinary plastics. Resists cracking, chipping abrasion, denting—yet amazingly light in spite of its ruggedness.

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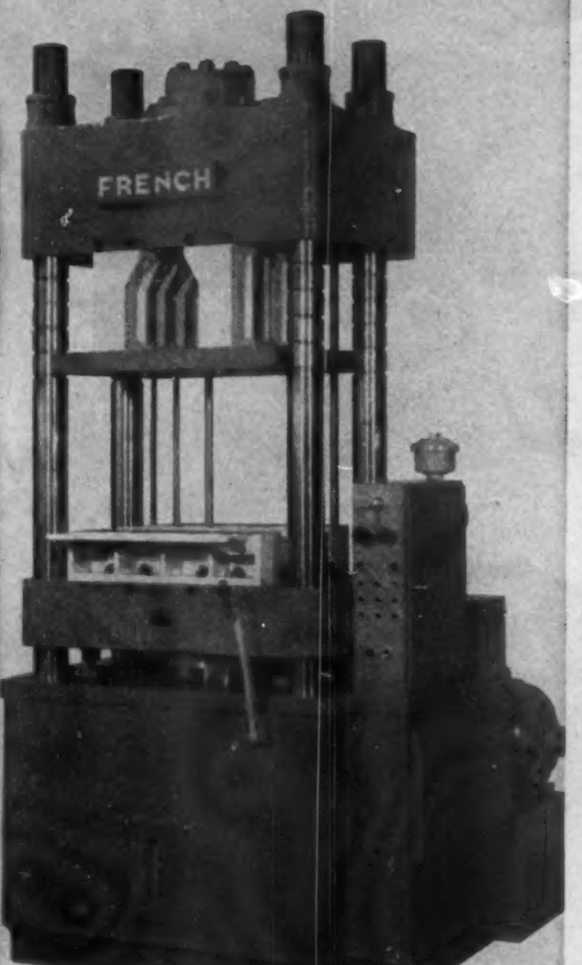

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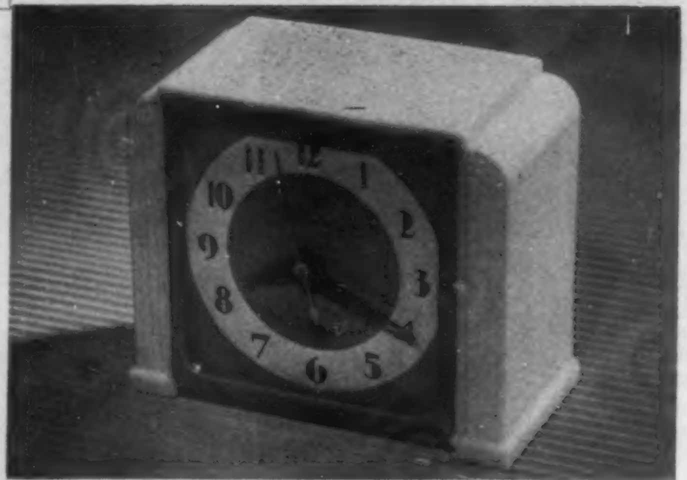

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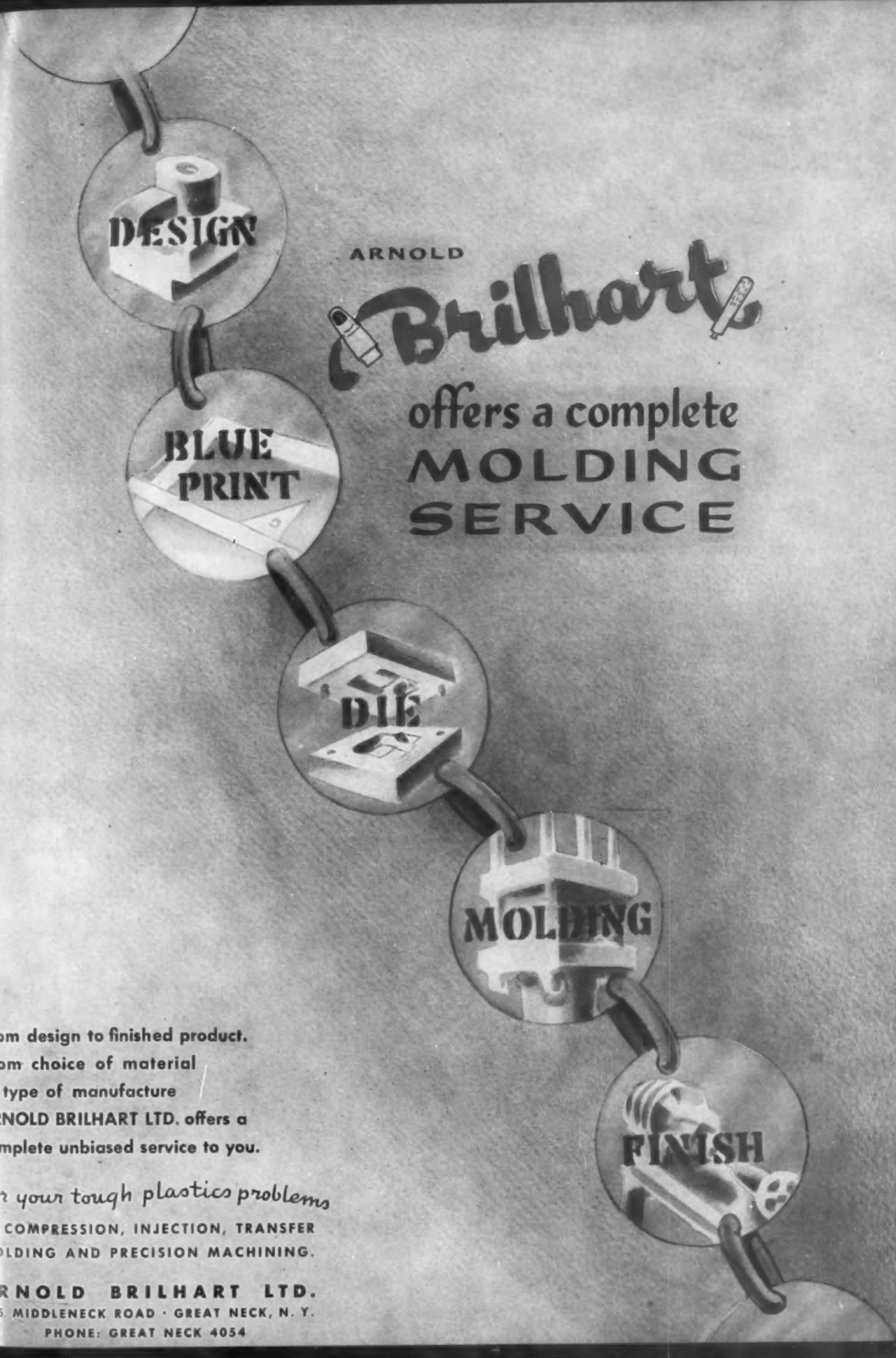

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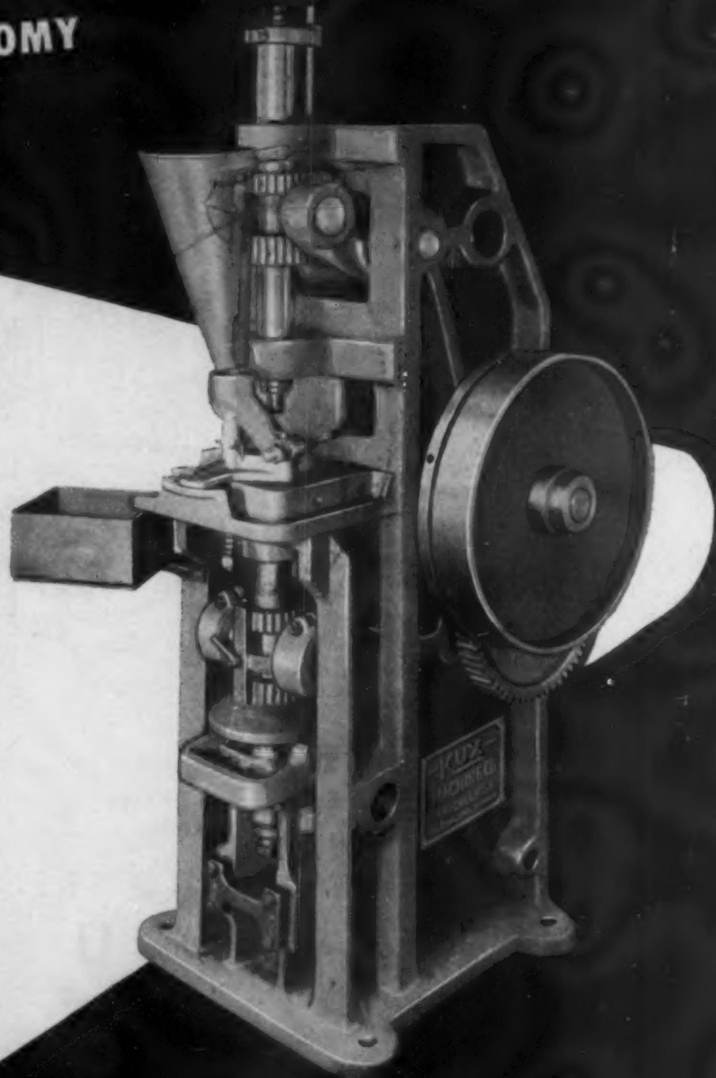

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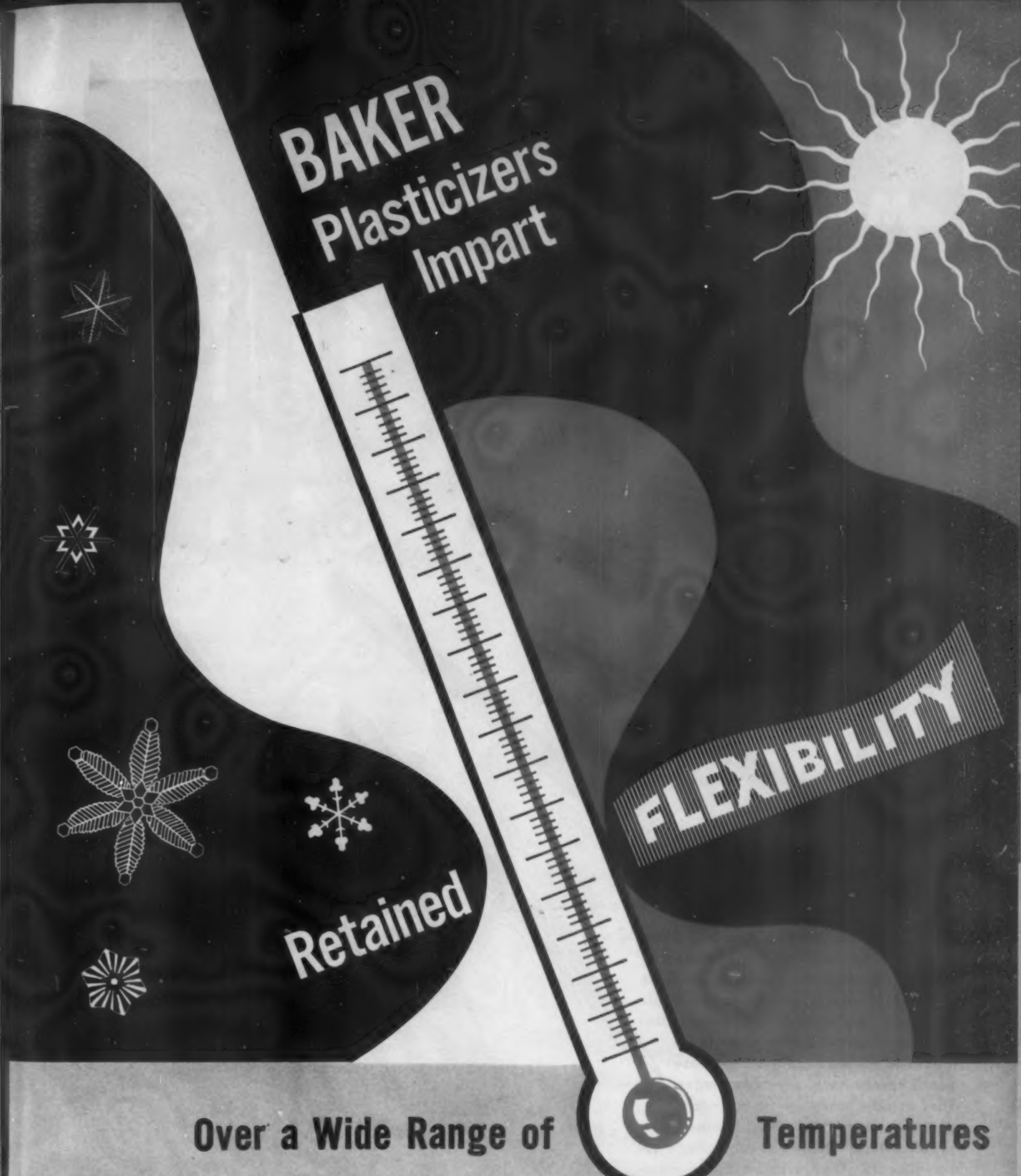
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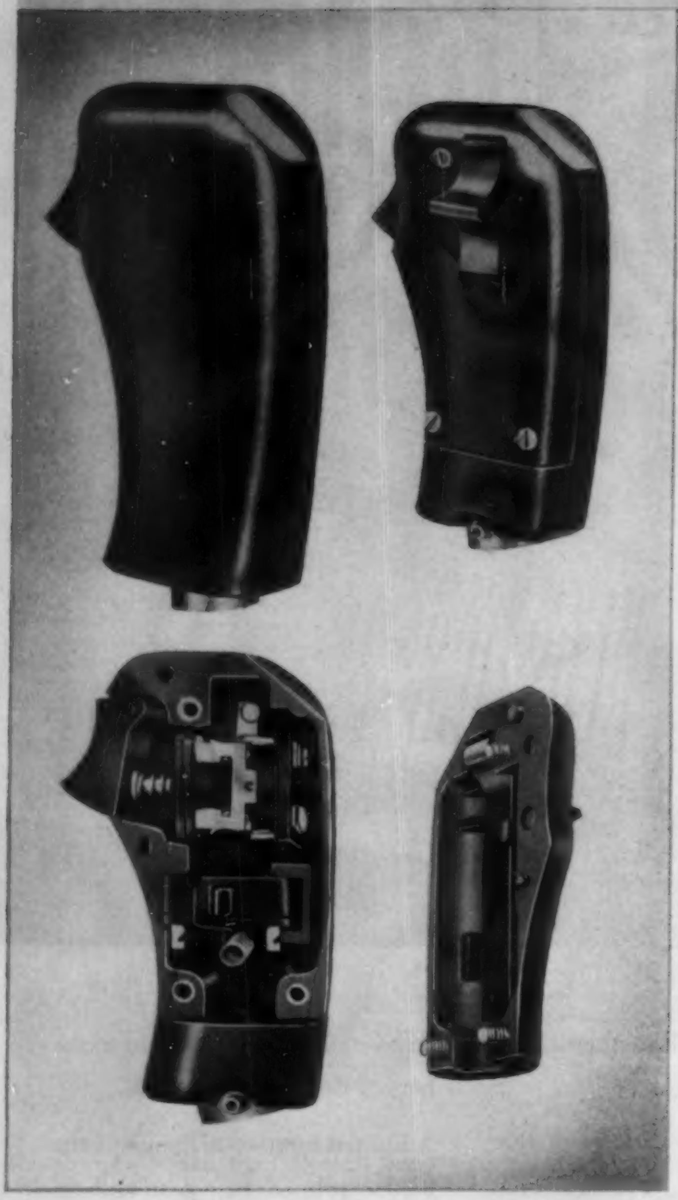

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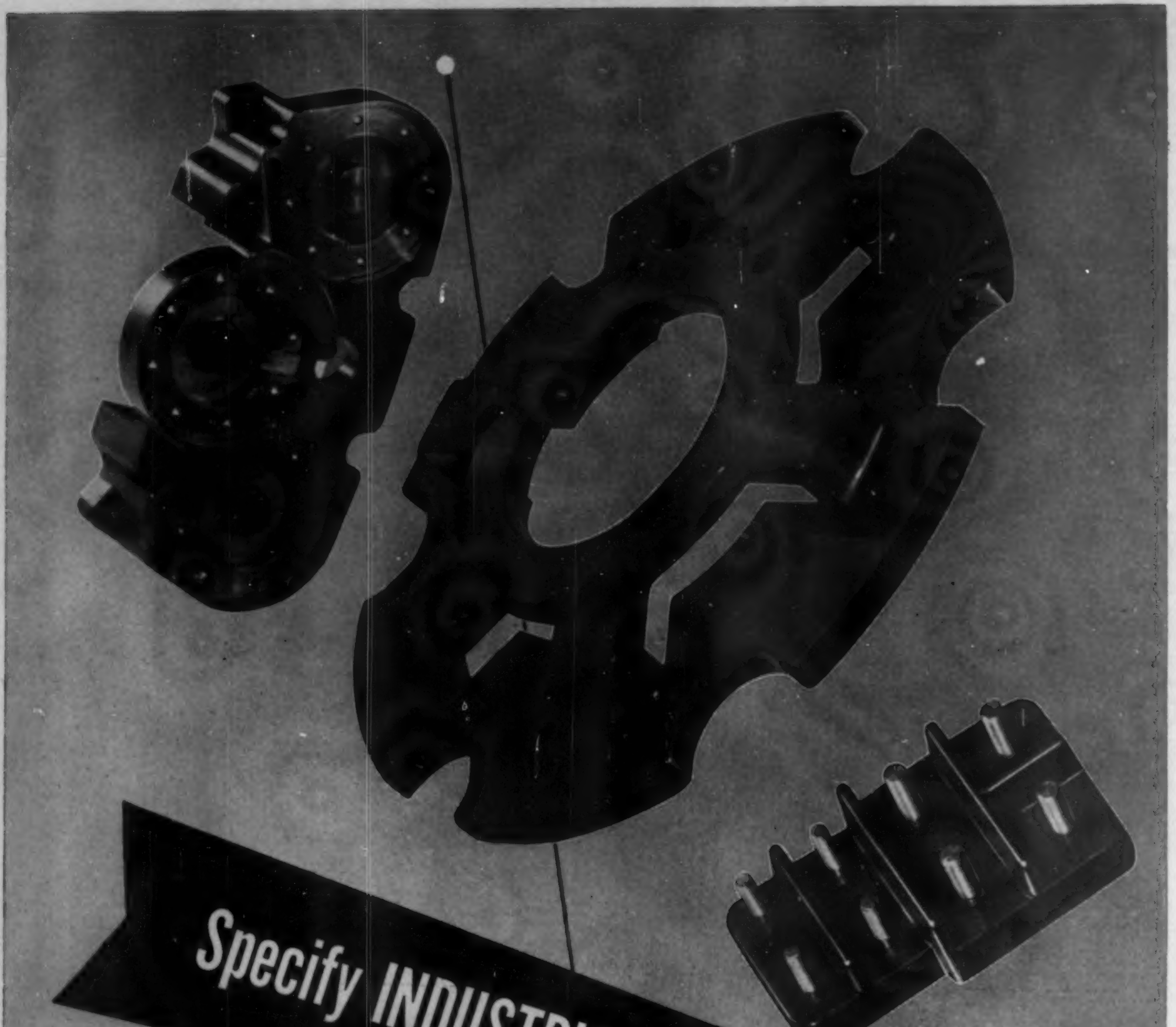

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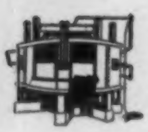

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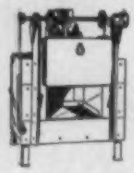

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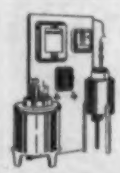

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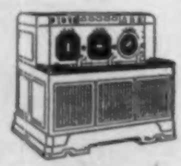

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MODERN PLASTICS
VOLUME 23 JULY 1946 NUMBER 11

Beauty and utility

A highlighting of some of the newer and more unusual uses of plastics in fashion

Mention fashion and the next word that comes to mind is beauty . . for it is beauty that women seek in their clothes and accessories. Some find it in color, some in line, others in the texture of their apparel. But whether it is color, line or texture they seek, women want it joined with utility.

The way plastics meet these requirements of the fashion conscious would be explanation enough for their use in every branch of this industry. But these materials have another property that is, in a sense, even more important. This is their *adaptability*. Whether the style of the moment demands sharp angles or gentle curves, stark simplicity or ornate surfacing, fragility or bulkiness, color or clear transparency, there is a plastic that fits the fashion.

What this means to the designer and manufacturer of fashion accessories is well exemplified by today's color trend. The prediction is that basic colors for fall and winter fabrics will be on the smoky side—smoke white, pale yellowish smoke, etc. Trimming and accessory colors, instead of being based on Chinese ceramics as they were last year, will be the more subtle jewel tones.

Not only are there plastics available, the acrylics and polystyrene to be specific, that can reproduce almost exactly the full color and brilliance of precious gems, but almost every type can be made up in any of these coming shades. Thus, shoe manufacturers, who seem determined to use some of the new wine colors in tones that have the brilliance of jewels, can find the answer to their needs in the vinyls. And the same is true of all other accessory houses—the designers of handbags, jewelry, hats, umbrellas—for such other plastics as the cellulosics, cast phenolic, urea and melamine, the extruded monofilaments and coated yarns are likewise available in a seemingly limitless range of shades and tones.

The adaptability of plastics to all the different fashion lines has been discussed in detail, field by field, in past issues of MODERN PLASTICS. The following four pages are not intended to show all the uses that have been made of plastics by accessory manufacturers but rather to suggest trends that should be worth watching and to picture some of the newer applications.

1—Novelty is always dear to a woman's heart . . . a fact that in itself assures these smart acrylic house slippers a ready market

2—The laundry problem is solved if collar and cuff sets and hats are made of fabric woven from plastic coated yarn that can be cleaned with a damp cloth

3—Whether the fashion accent is to be heavy or light, there is metal-plated plastic jewelry to fit the need. And the thickness of the coating can be varied according to style of the design

THE position of plastic materials in the women's wearing apparel and accessory fields is characterized by two extremes. On the one hand there are those plastic applications, umbrella handles and mock tortoise shell bag frames, for example, that women have been using so long and with such success that they unquestioningly expect them to be plastic. At the other end of the scale are such relatively new products as plastic patent purses. The success these bags are enjoying is coupled with a very real consciousness that the material is plastic. The complexion of both these groups will, of course, change as today's innovations become more familiar and as war-born developments are turned to the manufacture of civilian goods.

Shoes—Already well accepted, particularly in the play shoe field are plastic uppers, soles and trim. Part of the reason for plastic's success in this type of application is the variety that can be achieved. Take, for example, the shoes pictured in Fig. 5 which make use of loosely woven plastic coated yarn. In addition to novelty they offer variety of color and long wear, properties also enjoyed by the vinyl sheeting that is so popular as a trim material, by fabrics made from vinyl monofilaments and by the aforementioned plastic patent.

And at the spring shoe show in Boston there was the promise of the wide use of nylon for the uppers in women's slippers. Some manufacturers also expressed marked interest in embossed two-toned vinyl for the same type of application and in the prediction that plastic-treated leather would soon be on the market. Not to be overlooked, are such novelties as the acrylic at-home and bath slippers shown in Fig. 1.

Handbags—The list of materials used for the majority of plastic handbags is a duplicate of the one familiar

4—These cast phenolic and acrylic umbrella handles show how plastics adapt themselves to changing styles

5—When plastic coated yarn can be woven into the uppers of slippers such as these, it is little wonder that plastics are proving popular in the play shoe field

7—Hat designers are beginning to appreciate the beauty and the practicality of plastic materials. This cocktail hat, for example, is fashioned from cellulose acetate

6—White plastic patent has swept the country this summer as a handbag material. A hint of what lies ahead for fall can be seen in this dark vinyl coated pouch

8—Our explanation of the expanded use of plastic frames, like this one of cellulose acetate, is the adaptability of the materials to the winged shapes forecast for Fall

9—Opalescent plastic jewelry blends well with the colors coming into popularity

10—Women are only now getting their first limited sampling of the beauty and durability of dresses and coats fashioned of fabric woven from extruded monofilaments, like the waffle weave nylon used in this coat

to the shoe man. And as shoes are often decorated with acrylic and cellulose acetate bows, buckles and heels; handbags employ these same materials in their frames and bangles. The advantages of these materials for the frames in particular are emphasized in the newer bag silhouettes. Take the purses shown in Figs. 6 and 8. The fashion is for the outline of the frame to echo that of the pouch, and it would be impossible with any material other than plastic to achieve the flying, curving, projecting forms and at the same time preserve a soft texture and a full color range.

Hats—Hat designers more than any others are on a constant search for something different—in line, color, texture, material. Already top men and women in the field have created daytime and evening hats from nylon, cellulose acetate sheet, plastic patent and plastic coated yarn. But, as yet, the mass millinery market has not felt the full impact of these materials.

That plastics offer a lot to this branch of fashion is well illustrated by the two very different hat styles shown in Figs. 2 and 7. The first is a true time saver, for the fabric, woven from plastic coated yarn, seems to sluff off dirt. And even when dirt settles it can be banished by rubbing with a damp cloth. Incidentally, the collar and cuff set also pictured in Fig. 2 is equally practical, and other woven plastic fabrics are appearing in this type of accessory.

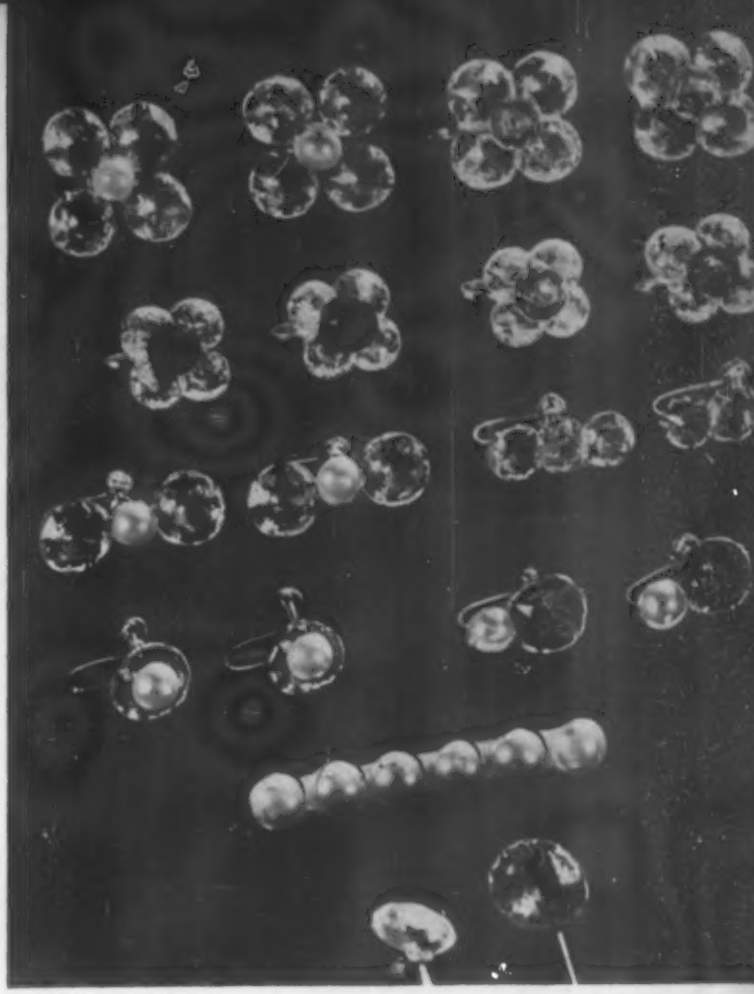
The piquant sailor in Fig. 7 well expresses the witchery that lies in the imaginative use of plastics in millinery—the transparent cellulose acetate sheet enhancing the beauty of the flower decoration.

Jewelry—Seemingly, there is nothing impossible of achievement in plastic jewelry, from the heavy metal plated bracelets in Fig. 3 to the glittering gems in Fig. 11. The war, which cut off supplies of imported synthetic jewels, gave the plastics industry its chance to show what it could really do in this line—both acrylic and polystyrene being used in the molding of these gems. The smoke tones that are being sponsored for fall fabric fashions should serve to increase the demand for both the molded jewels and for such stones as are shown in Fig. 9.

Rounding out this brief glimpse of some of the new applications of plastics to the fashion field is the swagger coat pictured in Fig. 10 and the umbrella handles in Fig. 4. With women still searching and waiting for nylon stockings, not many coats such as these will be appearing on the market. But they indicate the fashion designers' recognition and interest in all the varying types of plastic fabric. Right in step with this coat as far as swagger is concerned are the clear acrylic and bright-colored cast phenolic umbrella handles.

Credits for pictured accessories

Figure 1: Lucite. Slippers by Moglen Plastic Products. Vinylite straps.
Figure 2: Plexon. Hat by Hattie Carnegie.
Figure 3: Cohan-Epner Co.
Figure 4: Plexiglas, Lucite and Catalin by King Plastic and King Novelty Corps.
Figure 5: Plexon. Crochettes by Van Arden.
Figure 6: Westerman-Rosenberg, Inc., using frames by Hardy Plastics & Chemical Corp.
Figure 7: Lumarith. Designed by Don Marshall.
Figure 8: Hercules cellulose acetate flake. Bag by Garay & Co., Inc.
Figure 9: Lucite. Jewelry by Coro Jewelry, Inc.
Figure 10: Nylon waffle weave produced by Rodier Co. Coat designed by Carrie Munn.
Figure 11: Jewelry produced by Maurice Lichten



11—The jewel tones predicted for Fall accessories are inherent in the molded polystyrene (pictured here) and acrylic gems that are produced in every size and shape

Orchids that are ever blooming

It's hard to believe that this lovely cellulose acetate orchid is an outgrowth of war. But that's just what it is.

William M. Farris, a Navy veteran and maker of this delicate corsage, began his career in artificial flowers back when he was 12. Beginning with crepe paper he progressed to paper dipped in wax, then to copper. At this point he entered the Navy and his designing lay in abeyance until he joined a Red Cross occupational therapy class in the Navy Hospital at Long Beach.

It was in this hospital that he made his first experimental Lumarith orchid, the flower that now keeps 10 disabled veterans fully occupied. Cellulose acetate sheets 0.030 in. thick are used in this work which involves a total of 47 operations. Some of the forming is done by hand, some with molds; and the material must be heated and cooled several times. A cold dip dye, sometimes applied in the middle of the process, is employed.

When they are all finished, the flowers are packaged in transparent Lumarith hatbox-type boxes and tied with acetate ribbon. And so they reach the distributor, Ideas Unlimited, who sees that they reach milady.

PHOTO, COURTESY COLUMBIA PROTEKTOSITE CO.

1—Ever-increasing popularity of sun glasses has broadened tremendously the market for plastic eye glass frames. The colors in which these frames can be produced are largely responsible for sun glasses becoming a fashion must

The fashion is eye glasses—

2—Early sun glasses, like the sample on the near side in this photograph, were fabricated from cellulose nitrate rod stock. Later models were blanked out of cellulose nitrate and acetate sheet

THE present rage for spectacular spectacles is dependent on plastics. Rather than trying to wish them away, designers are making capital of eye glasses. Frames are styled to emphasize the facial structure of the wearer, to complement her ensemble, to act as picture frames for her eyes or to express the mood of the moment or the spirit of the activities ahead. Sometimes they are made up in bright, clear colors, sometimes in delicate pastel tones. Some are designed with broad bulky outlines, others with dainty streamlined curves.

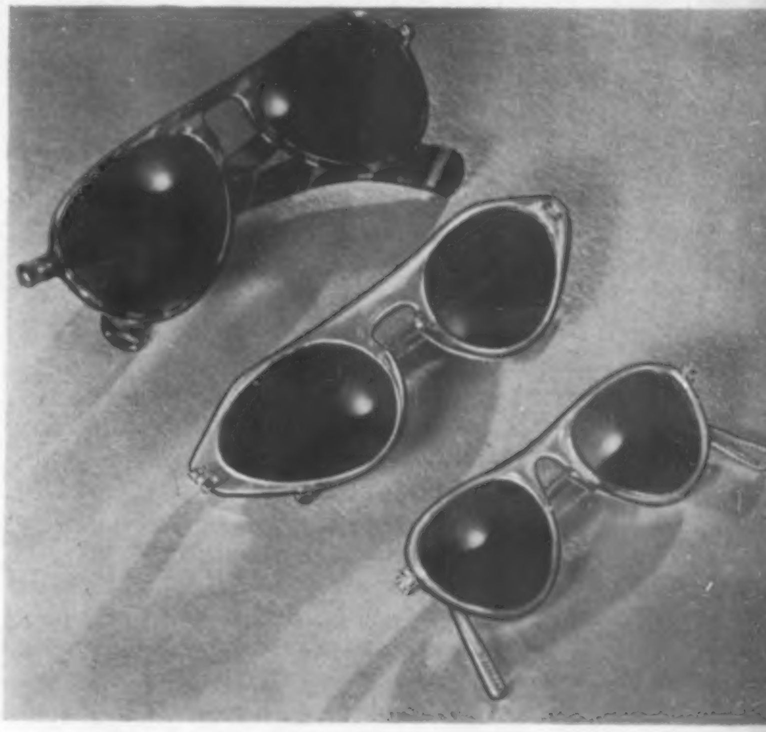
Plastics alone among materials offer the combination of light weight, strength, formability and color, or transparency, demanded by present eye glass styles. And, depending upon the material used and the method of production, plastic frames can either be priced well within the reach of the mass of the buying public or be offered as custom fitted luxury items. Less expensive spectacles, for example, are produced by the injection molding of cellulose acetate while the higher-priced frames are fabricated, from cellulose acetate, cellulose nitrate and acrylic sheet stock.

Spectacle wardrobes

To the manufacturer, this new approach to the designing of spectacles means a tremendous increase in demand. The single pair of glasses that once sufficed for all occasions is beginning to be replaced by a spectacle wardrobe. At an early spring style showing by Clairmont-Nichols, New York ophthalmologists, two pairs of business glasses in different colors and designs, one pair of play frames and at least one pair of high-fashion glasses for cocktails or evening were suggested as a *conservative* spectacle wardrobe.

Besides the carved and gem-studded acrylic frames shown at the top of Fig. 5 and the silver flecked spectacles pictured in Fig. 4 which catch each ray of light and set it dancing, this style show saw the introduction of a frame with detachable lenses. The lenses, either clear or tinted, are permanently mounted in narrow plastic rims grooved so that they can be snapped in and out of the spectacle frame. With this arrangement, one set of lenses can be used in a number of

3—Many of today's sun glasses, for men, women and children, are injection molded from cellulose acetate powder



for work and play

4—Spectacular spectacles are the fashion for the evening as they are for the beach, the street and for work

PHOTO, COURTESY CLAIRMONT-NICHOLS

5—Frames with detachable lenses are a development that promises to increase the demand for eye glass wardrobes

differently colored frames, or one frame can be used with both tinted and clear lenses (Fig. 5). It's not hard to figure how this development might furnish further impetus to the increasing demand for plastic frames.

And the wearers of prescription lenses represent but a part of the market for plastic spectacles. As America spends ever more of its leisure time in the sun—on the beach, the tennis court and golf course—sun glass manufacturers figure as even larger users of plastics.

Evolution of one make of sun glasses

That the sun glasses that now dot every city street and country resort are not new but simply improvements upon a well-established idea can, perhaps, best be attested by the history of one manufacturer of this type of glass, the Columbia Protektosite Company.

The first glasses put out by this company after its founding, about 1915, by Jos. Bonetti, Larry Fatori and Charles Haag, were fabricated by hand from cellulose nitrate rod stock. To give it the proper shape, the nitrate rod was heated and wrapped around a wooden mandrel. The result was a frame in which the nose piece was made up of two widths of rod (left in Fig. 2), formed when the rod that comprised the top and bottom of the frame was squeezed together at the bridge. Lenses were cemented in the frame by hand.

It was almost 15 years, until about 1930 in fact, before any drastic change was made in the manufacture of these sun glasses. Then cellulose rod stock was abandoned in favor of sheet material. The blanking out of the frames from sheet stock had a disadvantage, the wasting of approximately 70 percent of the material.

An interesting sidelight in this method of production was the way some of their competitors tore their hair trying to figure out how this company could sell such large frames at so low a price when measurements of the frames and calculations of the size sheet from which they must have been blanked out, indicated that the material cost was nearly that of the finished product. It is now possible to divulge the explanation of this seemingly impossible production feat. By heating the frames after they were die cut and placing them over a stretching cone, the company was able to greatly increase their size, thereby giving the erroneous impression that the frames were die cut from a larger sheet of material than was usually used.

After being blanked out, the frames were grooved, tumbled and dip polished with an acetone solution. Each one was then placed on a heating cone which stretched the frame enough to allow the lens to be inserted. As the frame cooled, it shrank in upon the lens to make a permanent assembly.

The next step in the evolution of this company's sun glasses came in 1934 when a large part of the production facilities were turned over to cellulose acetate sheet material. Methods of manufacture were quite similar to those used for nitrate sheet and no further changes were made for another two years, until the return of Mr. Bonetti and Mr. Haag from Germany with 8 Isoma injection machines. These were among the first machines of this type to go into production here.

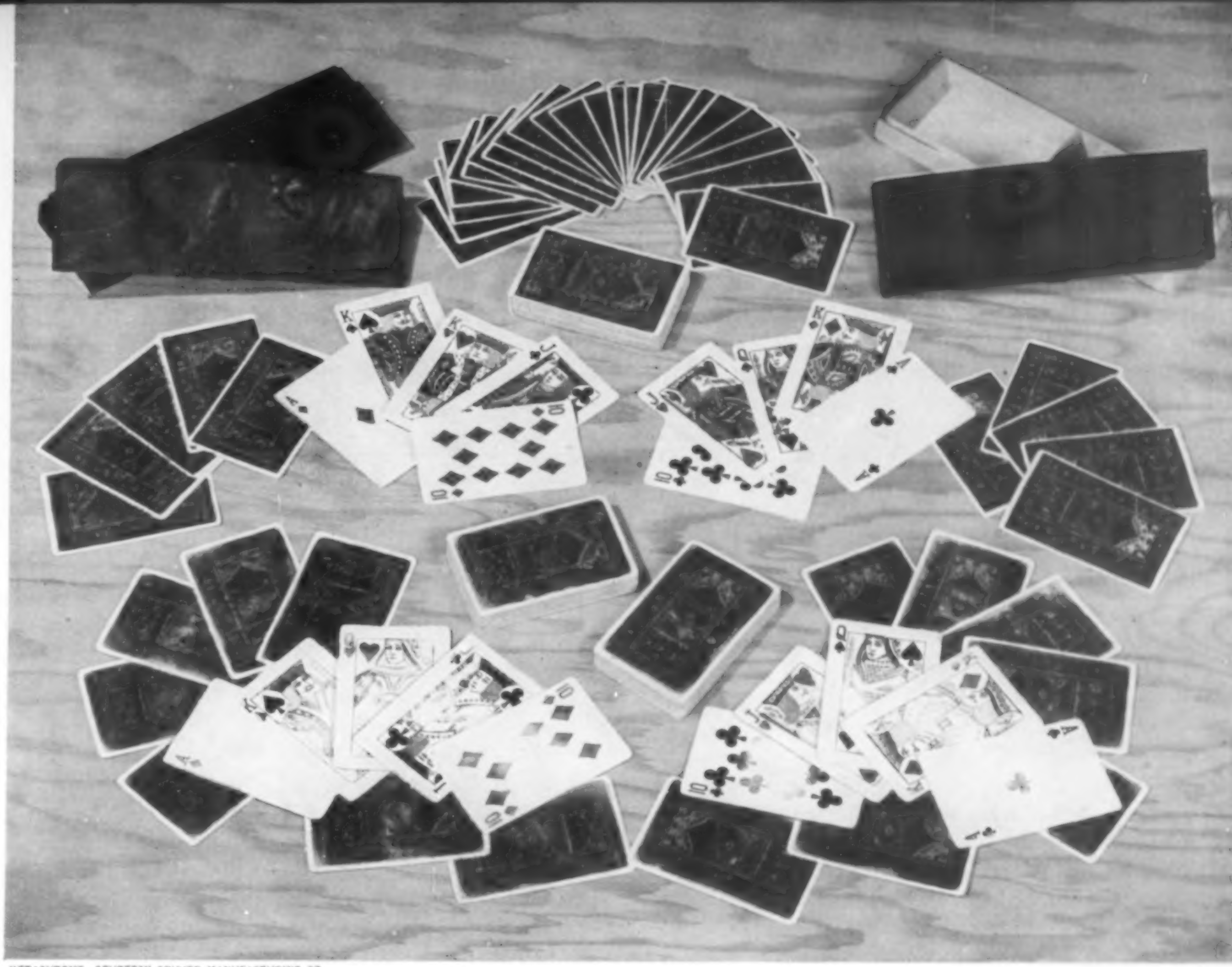
From fabricating to molding

The frames that the Columbia Protektosite Co. produced from cellulose acetate molding powder came from these 8 imported presses without grooves for the lens assembly. This grooving was done in a subsequent machining operation. At first the lenses were inserted by hand using the methods employed for the nitrate frames which involved the stretching of the frame, assembling of the lens and the shrinkage of the frames around the lens as they cooled. Today, however, the glazing operation is completed automatically. An operator merely places the two lenses in position in a frame and passes it through a piece of automatic equipment. When the firm bought American injection machines, production per machine took a spurt.

While the experiences of no two companies, whether in the sun glass or spectacle fields, are exactly alike, the history of this one firm indicates the ingenuity and engineering that has gone into the improvement of production—whether molding or fabricating.

THE FIRST STOUT FORTY-SIX AUTOmobile with Fiberglas body has made its long-awaited appearance. Designed by Wm. Stout, the car is constructed so that the body, except for the doors, consists of a single resin impregnated glass fiber laminated structure. As yet this is the only car produced of this material, but it is possible that others may be custom built by the same methods.

Other unusual features are an engine in the rear, no chassis or axles, literal cushions of air for springs, extra long wheel base and more interior room, allowing greater freedom and comfort for both driver and passenger.



KODACHROME, COURTESY CRUVER MANUFACTURING CO.

Wear in cellulose nitrate playing cards

A TOTAL of 1267 days of continuous card playing. Or, expressed in different terms, 31,408 rubbers of bridge or 125,632 poker hands. Such is the record of the pack of cellulose nitrate playing cards, manufactured by the Cruver Manufacturing Company, shown above at the left.

The letter reprinted in the accompanying box bears testimony to the service seen by these cards during two years of normal use prior to the end of 1941 and during three and one-half years of day-in and day-out use in a Japanese internment camp in Shanghai. And all of this play was done without any special regard or care for the cards themselves. How well the cards withstood the grueling wartime wear can be seen in the above illustration where the old pack is contrasted with another just off the production line.

In this practical test of plastic playing cards, one of the most severe known to date, the amazing thing is the condition of the cards themselves. True, the marathon play wore the printing somewhat but in no case was it dimmed to a point where the identity of a card was in doubt.

And the cards, according to those who have seen them—and they were on display at the recent Plastics Exhibit—deal and shuffle and snap like a new deck. Furthermore, the deck is still the same thickness as when it first came from the factory. There is no sign of the limp and delaminated corners sometimes seen on playing

2152 Shelby Street
Seattle 2, Washington
February 13, 1946

Gentlemen:

Under separate cover I have today forwarded you two packs of cards which were purchased here in Seattle in November, 1939. After having been in normal use for two years, until the end of 1941, they were taken into Internment Camp in Shanghai by my husband where they were used for three and one-half years throughout every day for playing solitaire and bridge in the evening. Apart from the printing being slightly worn, the cards are in excellent condition.

Yours truly,

(Signed) Mrs. Charles Wallace

cards that have withstood only a fraction of the severe punishment which has been meted out to these cellulose nitrate cards. Only the printing on the faces and backs show wear.

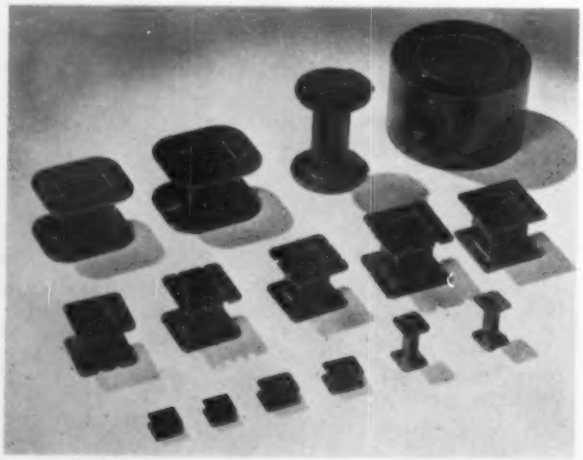
The material used in the production of the playing cards is a highly pigmented cellulose nitrate sheeting. After the cards have been printed in clear bright colors by the lithographing process, using inks specially prepared for this application, they are given a coating of lacquer on both sides. The lacquer is, in turn, covered over with a thin film of wax. The final operation is the blanking out of the cards from the printed and lacquered sheets of cellulose nitrate. The cards are marketed in attractive transparent plastic wrappers, two decks to a package and encased in cardboard or plastic boxes.

There is, perhaps, no better or more convincing proof of the performance of these plastic cards than that Mr. Wallace, whose cards stood the test of three and a half years in a Japanese internment camp, is now on his way back to Shanghai with several new decks of the cards in his bags.

A family of molded phenolic bobbins

Coil forms, or bobbins, find a wide range of use in transformers, hearing aids, radios and other electrical equipment. A number of materials, including paper, have been utilized for such bobbins, but experience has shown that plastics are ideal for this application because they lend themselves so admirably to the variety of shapes and sizes required. However, care must be taken to select the proper plastic for this application to insure the bobbins' meeting the varied requirements—such as high temperature resistance—demanded of them in their many differing jobs.

Mayfair Molded Products Corp. began specializing in the production of coil bobbins during the war and is now manufacturing, along with other small electrical components, the "family" of bobbins that are grouped together in the illustration accompanying this article. The smallest of these phenolic bobbins—a black general purpose medium impact phenolic material having proved itself best adapted to operating conditions—measures less than $^1/_2$ in. across the flange while the largest of the parts shown in the illustration has an outside diameter of $2^5/_8$ inches. This particular bobbin, which is cylindrical in shape, is a special type used in radar equipment. As can be seen the coil bobbins also vary in height and in contour, some being fat and squat while others are tall and small in cross section. And, just as the outside dimensions of these parts are designed to fit various types of equipment, so the center opening differs in outline and in size.



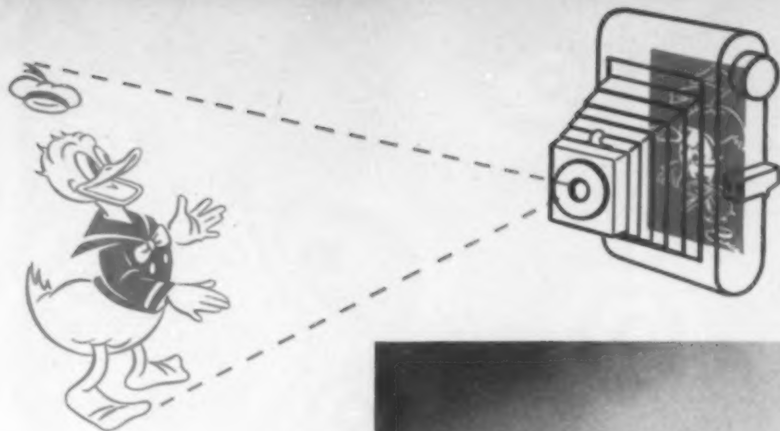
General purpose, medium impact phenolic material is used in molding these variously formed coil bobbins that range in size from ½ to 2⅝ in. in diameter

High production important

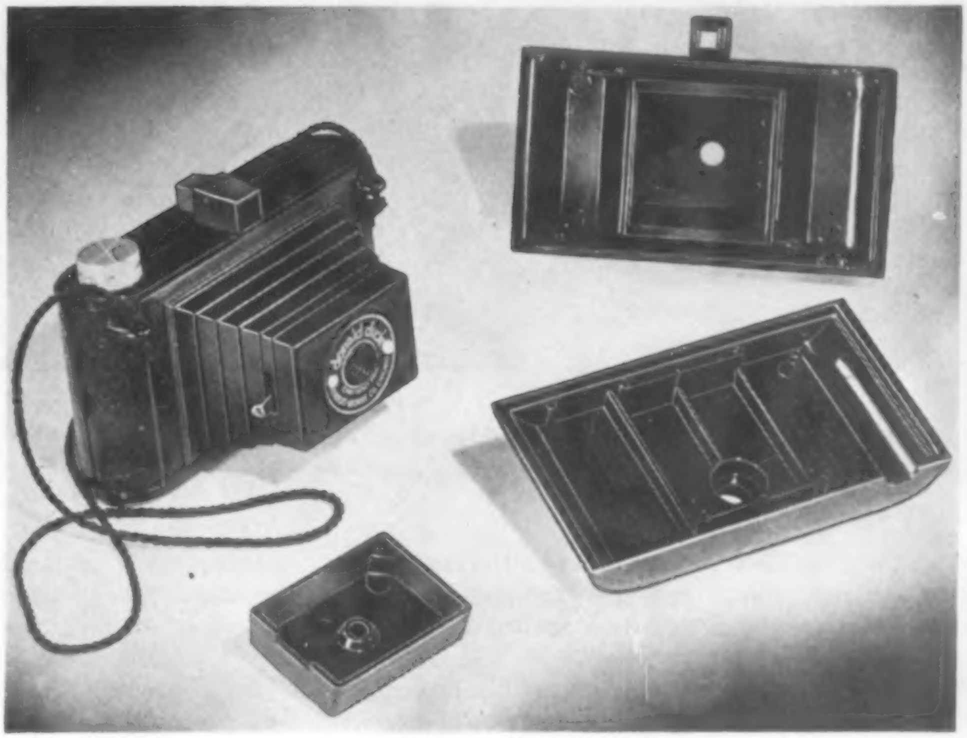
The Mayfair coil form family is molded on semi-automatic compression presses specially designed and developed by the company. Of 50-ton capacity, they incorporate electrically controlled cartridge heaters. Through fast press closing, a short curing cycle and rapid ejection of the pieces, high production is maintained with a relatively small number of cavities and a moderate cost of molds.

For example, on the smaller bobbins pictured, production rate of 120 cycles per hr. is attained, using a 2-cavity mold. This brings the total output to approximately 2000 bobbins per 8-hr. shift for a single press.

All the coil forms made by this company are of black general purpose and medium impact phenolic material, consisting of Durez 11540 and 1544 and Bakelite BM-120 or BM-6260. The powder is not preformed, but loading fixtures are employed to speed production. A dimensional tolerance of ± 0.002 to 0.003 in. is maintained on the bobbins, which are tumble finished to remove the light flash that is present. Because of the high temperature resistance of the molding material used, the coil forms may also be utilized as insulators.



Cellulose acetate butyrate or ethyl cellulose is used for body, back and shutter mount



Great precision is needed in the molding of the three plastic parts of this low-priced camera to insure proper functioning. The film must at all times be protected against light leaks and held at the proper distance from the lens

Three precision molded parts for child's camera

COMBINE the powerful merchandising appeal of Walt Disney's famous Donald Duck with a low-cost, precision-built, candid-type camera molded completely of plastic, and the result is a natural for children six years of age and up.

The new plastic Donald Duck camera, declared to be the first camera designed expressly for children, is being promoted in a manner similar to that used several years ago for the Mickey Mouse Ingersoll watch. Prior to the war, a million watches a year were turned out.

What's in a name?

The Donald Duck name, used through special arrangements with Kay Kamen Ltd., which handles the merchandising of all Walt Disney products, gives an unknown camera of good quality the immediate recognition and acceptance of an established product.

Despite its obvious sales punch, however, this new product could never have attained its present national and international distribution had not it been capable of turning out good quality photographs. Retailing at just under 3 dollars, the unit was specially developed to give the juvenile photography fan a sturdy instrument, simple in operation, which could be relied upon to produce creditable pictures under average lighting conditions. The finished camera, available in black and olive drab colors, measures $4^1/_2$ in. wide by 3 in. high to the top of the viewer and $2^3/_4$ in. from front to back. Using standard No. 127 film, it gives 12 exposures per load. The negatives, $1^5/_8$ in. square, yield good quality contact prints or sharp enlargements. Virtually foolproof operation is assured by the preset bellows, instantaneous shutter and optically ground meniscus lens.

The camera includes three basic molded parts—the

Back section of the camera being removed from a 6-oz. injection molding press. Molded-in film-viewing hole can be seen

Worker is cutting sprue from the body section of the camera which has been turned out in a 9-oz. machine

body, the removable back and the shutter mount, in which the lens and shutter assembly are located. These plastic components are injection molded of cellulose acetate butyrate or ethyl cellulose by Amos Molded Plastics for the Herbert George Co., which assembles the finished units. These two plastics were chosen for their good dimensional stability and lack of chemical reaction on the film. The backs are molded on a 6-oz. press, the body portion on a 9-oz. machine and the shutter mount, smallest of the plastic components, on a 4-oz. machine. The use of olive drab and black insure adequate opacity to prevent light from penetrating the walls of the camera and exposing the film.

Operation involves special problems

Molding an efficient low-priced camera requires close attention to a number of details not ordinarily encountered in most products made for sale to children. A camera, if it is to function properly, must fully protect the loaded film against light leaks and must support it closely in position so that the distance from the lens to the shutter does not vary.

The problem of film protection requires a close fit between the body of the camera, in which the film spools are placed, and the removable back. To guard against light penetration in the Donald Duck camera, the back has a friction fit calling for a high degree of accuracy on the molded parts. Since children can hardly be expected to exercise as much care as adults in closing the back of the camera, it was found advisable to provide a protective skirt between the body section and back.

One of the most critical problems faced by the molder was the necessity of maintaining an accurate focal distance—the measurement from the film to the lens. On this dimension, a tolerance of ± 0.005 in. is held in the molding. The dimension is controlled primarily by the depth of an internal section molded in the body piece. The film extends across the rounded open back of this section, being held in close proximity to the body piece by means of three projecting ribs molded into the inside of the back section.

When the film is placed in the camera and the back snapped in position, the camera must provide a smoothly surfaced slot through which the film passes from supply spool to wind-up spool. Since no rollers are used over which the film may travel, the necessity of maintaining close tolerance at this point is readily apparent.

No less vital, from the standpoint of accuracy, are the slots at each end of the body section into which the film spools are inserted in loading the camera. These molded-in slots serve as bearings in which the film spools rotate as the film is wound for successive exposures. There is a matching pair of slots on the left side of the camera, where the full roll is loaded, and a single molded-in slot at the bottom on the right side. A knurled film winding knob is installed opposite this last slot during the assembly operations. The boss surrounding the winding knob opening is recessed to match a flanged portion of the back section of the camera which, by providing an overlap, seals this critical point against the entrance of light.

The film spools are supported firmly in position by three extensions molded on the inside of the back section, which match the position of the spool slots in the body piece. Smooth progression of the film from supply spool to take-up spool depends on the precise alignment of these slots. All holes in the camera sections, including the side opening for the winding knob, are molded automatically in one operation.

Interior ribs, which hold film firmly against body, are carefully checked when inspecting the back section of camera

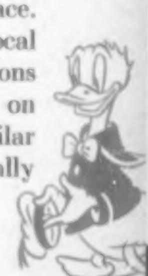
Lens is fastened to body by a spinning press that decends on plastic lip, melts it to seal lens in place

Many of the features which add to the appearance of the Donald Duck camera or cause it to resemble more expensive candid-type instruments are molded directly into the case. The exterior is surfaced in a simulated leather grain, with the back panel carrying Donald Duck and three small ducklings, molded in relief. The eye-level viewer molded on the top of the body section is particularly valuable in helping juvenile camera fans to get the picture they want. The silk neckband is anchored in two eyelets molded as integral parts of the body section. The shutter mount section, or nose piece, has a circular recess into which the metal nameplate fits. In assembly, this metal component slips over a lip on the front of the body section to provide a light seal. The shutter mount is molded with a slot in the right-hand side, through which the shutter actuating tripper extends.

The assembly operations, during which the shutter mount, body and back sections are combined and the various non-plastic parts installed, are performed at the Herbert George plant. All assembly operations are expedited by specially adapted jigs, drills and punches.

Illustrative of the continuous improvement in molding and assembly operations is the manner in which the lens is fastened in the body section. Formerly, the lens was held in position by a flat metal retainer having a ring-like opening at one end which encircled the lens and pressed it against the inside surface of the body section. This method of lens mounting had some disadvantages, in that if a lens varied slightly from the required thickness, the focal length of the camera was altered, tending to reduce the sharpness of pictures.

In the revised design, the lens is placed in a small countersunk depression in the front of the body section and sealed firmly into position by bringing a rapidly rotating grooved tool down over it. The tool, spinning at more than 2000 r.p.m., contacts the small lip of plastic projecting above the lens and the heat and pressure produced as the drill press is lowered cause the lip to soften and flow, sealing the lens permanently in place. With this new method of lens mounting, the focal length of the camera is not affected by slight variations in lens thickness. The $^1/_2$-in. red acetate window on the back of the camera is sealed in position in a similar manner, except that a non-rotating tool, electrically heated flows the plastic lip into position.



Using electric screw drivers, shutter and mount assembly are joined together with a $^5/_8$-in. drive screw

A bright future for coated fabrics

Today a large percentage of vinyl coated fabric is going into automobile and furniture upholstery but other outlets are opening up—in footwear, sports goods, Marine applications, to name but a few

PROCESSORS of coated fabrics and unsupported film for purposes such as upholstery of all types—furniture, theatre seating, vehicles, water craft—as well as luggage, handbags, footwear, workers' clothing and a host of other products, have already become one of the plastics raw materials manufacturers' greatest consumers, yet they have just begun to scratch the surface of their potential market.

Plastics coated fabrics have been used since the turn of the century by bookbinders, upholsterers and others. Until just before the war, however, the coating material was largely a cellulose nitrate base known as pyroxylin and the finished product was called artificial leather. But, spurred on by the needs of fighting men for a material that could be made flame, abrasive, age and mildew resistant, processors made rapid advancement in handling supported and unsupported vinyl film. Among the first to develop and introduce vinyl coated fabrics was the Textileather Corp. whose products are discussed in this article.

As one of the leading producers of leather-like fabrics since the early days of pyroxylin coating, this company had started its research and proving-ground work on vinyl coated materials before the war. Hence, war's outbreak found the company's new vinyl coated product—Tolex—all ready for duty. Military demands soon required the entire production of Tolex for uses such as Army and Navy rainwear, aircraft engine and propeller covers, aircraft and weasel upholstery, fliers' sleeping bags, Navy life jackets, life raft sails and carrying cases, hospital sheeting, Navy bedding bags and a host of other wartime requirements, many originally designed to be met through the use of natural rubber coatings.

This new material met the most severe requirements of the Armed Services, particularly with respect to low temperature resistance, abrasion and flexing resistance, pliability, resistance to mildew and non-inflammability, resistance to acids, alkalis, oil, salt water, et al. Company officials assert that, properly coated, vinyl coated fabric surpasses anything heretofore available in ability to withstand flexing, folding and abrasion. It is not subject to chemical change through oxidation. When properly plasticized it is resistant to cold cracking, alcohol, mineral oils, vegetable oils, fire and salt water. It is waterproof and can be easily cleaned with soap and water.

Vinyl for upholstery

For upholstery, it has several reputed advantages:

1. It is becoming increasingly available today despite the shortage of vinyl resins, plasticizers and stabilizers.
2. Vinyl coated fabric compares favorably in price with other upholstery materials.
3. Vinyl coated fabrics and the unsupported film cut like cloth with little waste.
4. It does not crack, crock or stain—alcohol, blood, acids can be easily wiped off without staining.
5. It can be flameproofed, attested by the fact that Tolex meets requirements of New York City's Board of Standards and Appeals for upholstery and decorative applications.
6. As in many other plastics products, it has brilliant and permanent color-appeal which is one of the important sales arguments for the vinyls.

At present a large percentage of this vinyl production is being used as upholstery, chiefly for automobile and furniture applications. The automotive industry in particular is a large actual and potential user of vinyl fabrics for upholstery and interior trim in pleasure cars, truck-cabs, buses, station wagons and convertibles. The characteristics of vinyl resin coatings make this type of upholstery extremely logical for these and many other applications.

The furniture industry has always used great quantities of fabric coated with pyroxylin or rubber. Vinyl coated fabric will give additional impetus to this market because it can be used with deep spring cushion construction as well as the so-called hard cushions. It is particularly adapted to office and porch furniture, where the upholstery must take rough every-day usage and, in the case of outdoor furniture, exposure to the elements. For theatre and auditorium seats and institutional uses, such as chairs in shoe sections of department stores, it will withstand the heavy usage of a constant flow of customers. For commercial uses such as bar rooms, hotels and beauty parlors, vinyl upholstered chairs are particularly adaptable, because they wear well and are easy to clean.

Upholstery for boats is another prime market. In this field vinyl has the advantage of withstanding moisture, salt spray and oil.

Other uses for coated fabric are volley balls, basket-

balls, footballs and low-cost baseballs which were formerly made entirely from rubber and pyroxylin coated fabrics. The U. S. Army was on the point, when the war ended, of requesting 100,000 yd. of vinyl coated materials for this purpose, after tests indicated that they were satisfactory for inflated balls.

Plastic patent film

In addition, Textileather Corp. is now manufacturing considerable quantities of plastic patent film for shoes and handbags under the trade name of Patent Suporfilm. It is believed that polished plastic film with a fabric base and designed for woman's shoes in the 7 dollar or over range will prove to be one of the top grade markets for the company's line. Many thousands of pairs of shoes fitted with this polished plastic have been placed on the market.

Equipment for the polishing process is a heavy multiple platen hydraulic press, operating at high pressures. It is equipped with two rams.

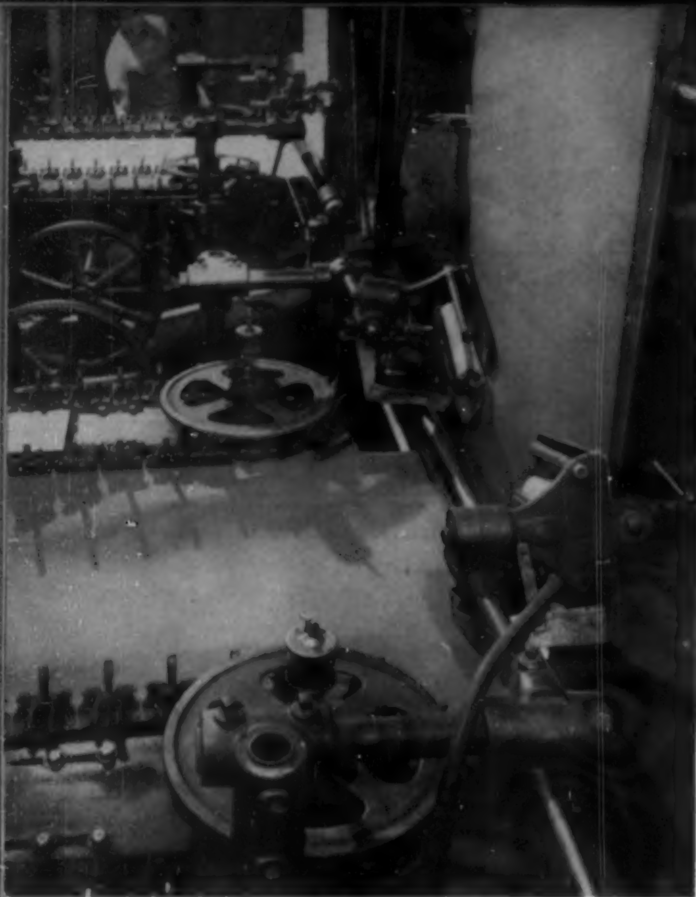
The charge, or sandwich, is made by laying alternate sheets of unpolished vinyl sheet, either supported or unsupported, against polished chrome-finished steel plates. The press is closed hydraulically and steam heated. Temperatures and pressure are controlled by a complicated thermostat system, the key to which is an electric thermometer called a thermocouple.

While the charge is being treated, two men remove the finished sheets from a previous batch and send them on their way to the inspection table, after which they are carefully packaged in tissue paper in 50-sheet lots of 6 sq. ft. per sheet. Extreme care must be taken in packaging to prevent movements while in transit which might cause wrinkling or creasing.

Company officials assert that without a fabric backing plastic patent would stretch and the shoe would lose its shape. In any case, the vinyl patent plastic shoe material is comfortable, flexible to foot contours, has exceedingly good wearing qualities and will not scratch or crack.

Patent plastic is, of course, available for other products such as belts, pocketbooks and novelty cases, many of which have been and will continue in nitrocellulose. Either grained or patent plastic for ladies' bags is generally unsupported because it drapes for styling more easily without a backing. The company's

Chairs such as these are but one outlet for vinyl coated fabrics in the furniture field. Other applications are to be found in the outdoor and institutional furniture



PHOTOS AND COLOR PLATE, COURTESY TEXTILEATHER CORP.

Tent frames (left) are used with almost every cotton textile finishing operation to regain width following finishing. High molecular weight resins in various thicknesses are coated on a single continuous strip of fabric in one calendering process (right). Steam is used for heating the mill and the calender rolls.

unsupported plastic patent is known to the trade as Patent Stablfilm.

Mechanical know-how

The ability of this company to use vinyl compounds in establishing Tolex and other new lines of coated fabrics no doubt stems back to their know-how resulting from years of working with pyroxylin. And of special importance have been their pioneering research work in the field of vinyl coating of fabrics, together with experience in producing coated materials of many types for the Armed Services. Their varied experience in dip, spread or calendered coating made it possible for them to work on all the numerous types required, but a visitor to their plant gathers the impression that they are most proud of their achievements in calendering.

Coaters who at the start of the war were equipped for solution coating only, needed but slight changes to adapt their machines to polyvinyl chloride or copolymer coatings. But they were limited to light coating weights because the solid contents of those coatings are only from 25 to 30 percent. The fabric would have to be run through the coating machine several times if a thick layer was needed. In contrast the heavier coatings can be applied with only one pass.

But the old type calendering machines were not built to operate at the high temperatures required for working the higher chloride-content resins. On such machines it was generally necessary to blend the higher and lower chloride-content resins so they could be processed at lower temperatures. Such blends did not have properties of higher chloride-content compounds.

To overcome these difficulties this company acquired two new calendering machines[1] with special features which gave greater efficiency when operating at higher temperatures. High pressure steam is used for heating the mill and four calender rolls, and constant steam pressures are maintained by pressure regulators.

Before the coating material is placed in the calender the basic raw materials are mixed in Banbury mixers jacketed to allow circulation of either water or steam. After they are charged into the Banbury the raw materials are allowed to mix for 5 to 15 min. until a batch temperature of approximately 300 to 325° F. has been reached. The fluxed compound is then mixed some more and kept hot on two-roll mills from which it is fed to the calenders and applied to the base fabric.

To insure adequate adhesion of coating to base fabric, suitable means must be provided for preheating the fabric prior to entering the calender nip. To prevent sticking at the wind-up end of the unit, means for cooling the calendered goods must also be provided.

The choice of plasticizers, pigments and stabilizers is today one of the most confidential parts of the business and the most worthwhile knowledge has been gained in the hard school of experience. The kinds and amounts depend upon the purpose for which the coated fabric is to be used. Heavy gage upholstery Tolex uses roughly 30 percent plasticizer; the re-

[1] Purchased from Farrel-Birmingham Co., Inc.

mainder is resin plus pigment, filler and stabilizer.

The fabrics most commonly used for backing are sateen, broken twills and sheeting.

After the coating process is completed the material is then generally embossed and finished. Embossing is still an art rather than a science and each company guards its process carefully. In the case of roller embossing, a steel engraved roll and a paper roll are geared together with the cloth passing between them.

The other method of embossing is through the use of automatic hydraulic presses of the horizontal type. In this method interchangeable plates or designs are placed on a large press and the cloth is automatically carried through, 24 in. per impression. Textileather Corp. has more than 250 patterns made up of rollers and plates. Embossing on vinyl has presented many new problems entirely different from pyroxylin.

Lightweight materials

Lighter weight fabrics are not generally adaptable to coating on calenders. For such applications the vinyl resins, along with the necessary plasticizers, pigments, fillers and stabilizers are dissolved in solvents, and the resultant solution applied to the fabric either by the spreader or dip method. The higher chloride-content resin coatings must be heated to maintain proper coating viscosity. Even when heated, the solids content of these solutions is relatively low (20 to 30 percent) and as many as 12 to 18 coats may be required to apply a few ounces of coating per square yard. New latices and non-solvent dispersions coming on the market will no doubt create many changes in this type of coating process which has heretofore required extensive apparatus to remove solvents from the solution and then recover them for reuse.

Company officials feel that knowledge gained during the war has given the coated fabrics industry a background of experience which would take 5 to 10 years in normal times and that the vinyls have given them a general-purpose coating material which can be formulated both for light and heavy fabrics, from shower curtains to upholstery or luggage.

CIVILIAN APPLICATIONS FOR SUPPORTED AND UNSUPPORTED FILM*

AUTOMOTIVE

Decking
Sport Topping
Upholstery
Head lining
Panel Boards
Winter-Fronts
Truck Paulins

UPHOLSTERY

Chrome Furniture
Institutional Furniture
Outdoor Furniture
Commercial Installations

CASE COVERINGS

Optical Instrument Cases
Radio Cases
Camera Cases
Jewelry Cases
Typewriter Cases

SPORTING GOODS

Baseballs
Footballs
Basketballs
Golf Bags

RAIL

Vestibule Curtains
Upholstery
Wall and Window Coverings

BOOKBINDINGS

Edition Bindings
School Annuals
Ring Binders
Albums and Textbooks
Check Book Covers
Diploma Cases

WATERCRAFT

Sedan Tops
Upholstery
Cabin Coverings
Life Jackets

FOOTWEAR

Shoes and Sandals
Slippers
Patent Finish

LEATHER GOODS

Handbags
Belts
Purses
Wallets
Brief Cases

AIRCRAFT

Cabin Linings
Flameproof Upholstery
Engine Covers
Insulation Blankets
Wing Covers

PROTECTIVE CLOTHING

Aprons
Sleeve Guards
Gloves
Coats
Overalls
Baby Pants

BAGGAGE

Suit Cases
Sample Cases
Trunks

MEDICAL

Oxygen Tents
Hospital Sheeting
Upholstery
Wall Coverings

HOME FURNISHINGS

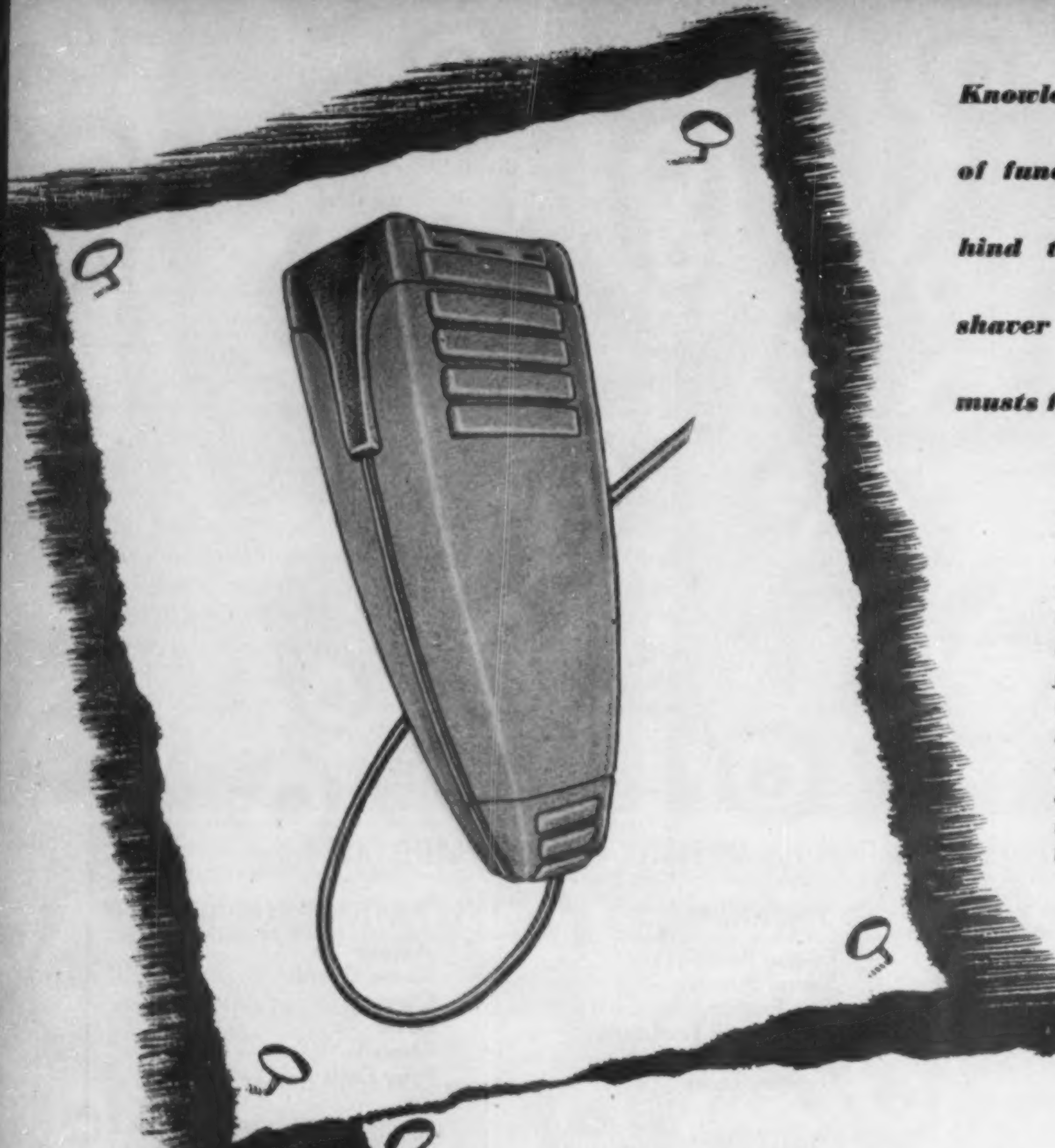
Hassocks
Screens
Wall Coverings
Bridge Table Sets

MISCELLANEOUS

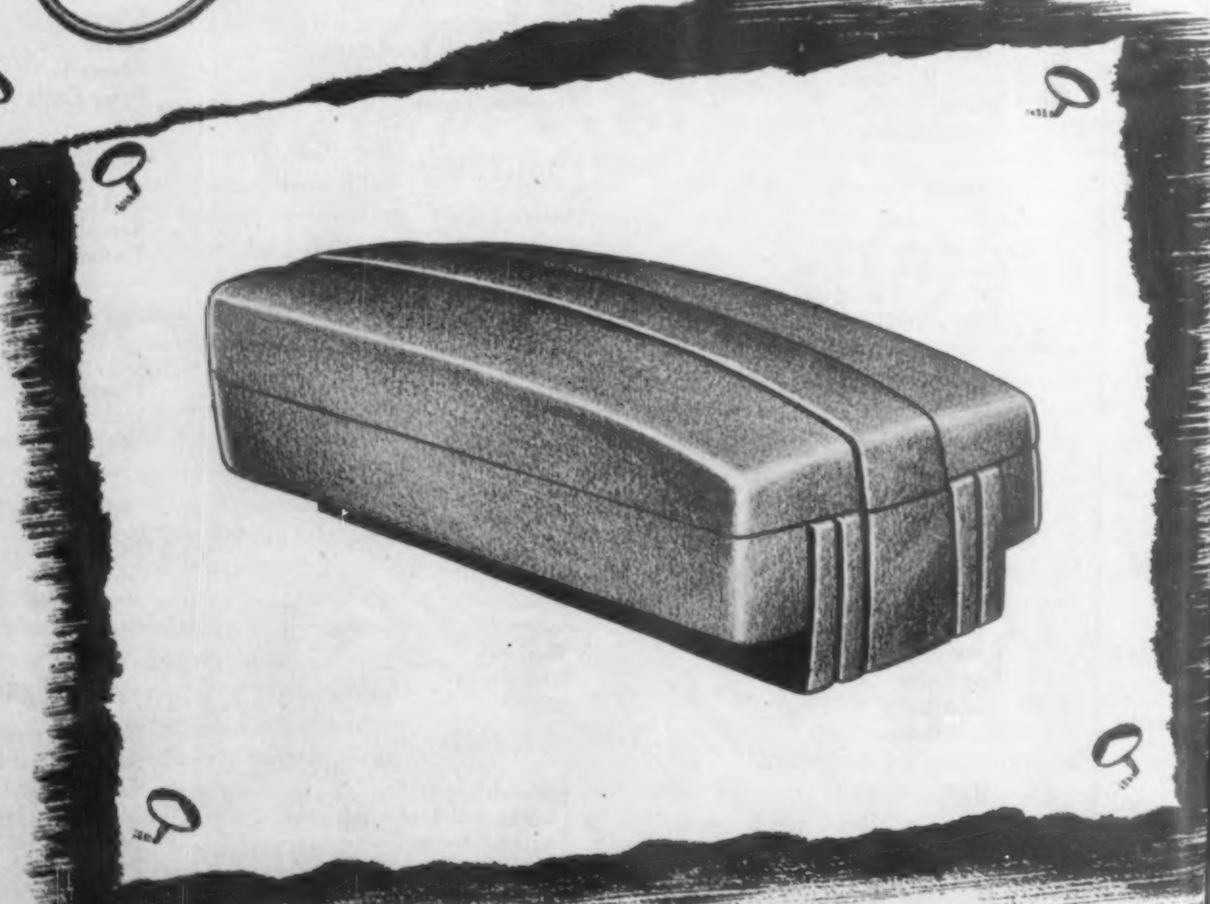
Baby Carriages
Bicycle Saddles
Table Pads
Vacuum Cleaner Bags
Motion Picture Screens
House Trailer Coverings
Gimps, Welts, Bindings

* Material supplied by Textileather Corp.

Knowledge of form and of function, which lie behind this redesign of a shaver and housing, are musts for today's designers



The way a unit operates and the way it can be produced must both be considered when plastic items are designed or redesigned. Both factors are balanced in this suggested design for an electric shaver. The case is reduced in depth and constructed with 5 raised sections so it may be more easily gripped



What to do with the electric cord of a shaver? This is solved in a proposed design for a molded plastic box. The bottom has been recessed to enable the stowage of the cord beneath the shaver

Industrial design — *What is it?*

by GERALD STAHL

"FORM follows function," has been accepted as an axiom of *good* modern design. It follows that a designer must understand function before he can arrive at practical form. The all important term, function, encompasses a wide variety of factors for the sales-conscious manufacturer. These can be subdivided under:

1. Costs
2. Eye or sales appeal
3. Serviceability

But to predetermine the cost, sales appeal and serviceability factors involved in a product development problem, the designer must have the necessary practical knowledge. The alternative is endless submissions of useless pretty pictures to the manufacturer for correction and revamping.

A part of a team

No one designer—or design staff—can reasonably qualify as production engineer, cost accountant, mechanical engineer, stylist, and sales, distribution and merchandise expert while possessing all the other specialized job skills that are demanded of the team of experts behind modern production and distribution. In other words, the designer cannot know more of a manufacturer's business than the manufacturer himself. He is, however, an essential member of this coordinated team. To properly hold this position, he must understand and appreciate the functions of his associates in order to harmonize his efforts with that of the whole group.

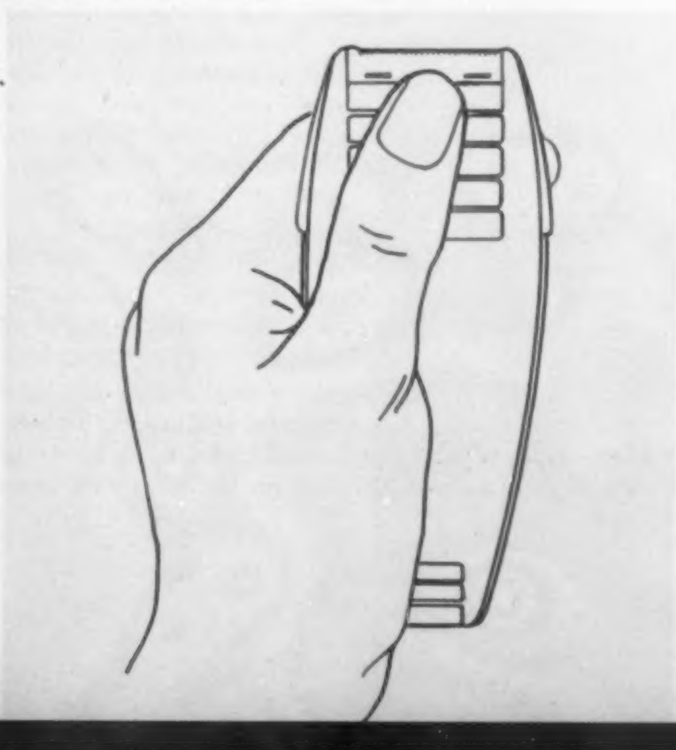
To do this, the industrial designer must at least be familiar with the properties of materials, tool and die possibilities and limitations, manufacturing processes, principles of mechanics and physics, and methods of distribution. With such a background, he can incorporate into his designs features that will keep costs of manufacture and distribution at a minimum. The manufacturer will not then be forced to eliminate repeatedly, impractical but pretty ideas of the designer.

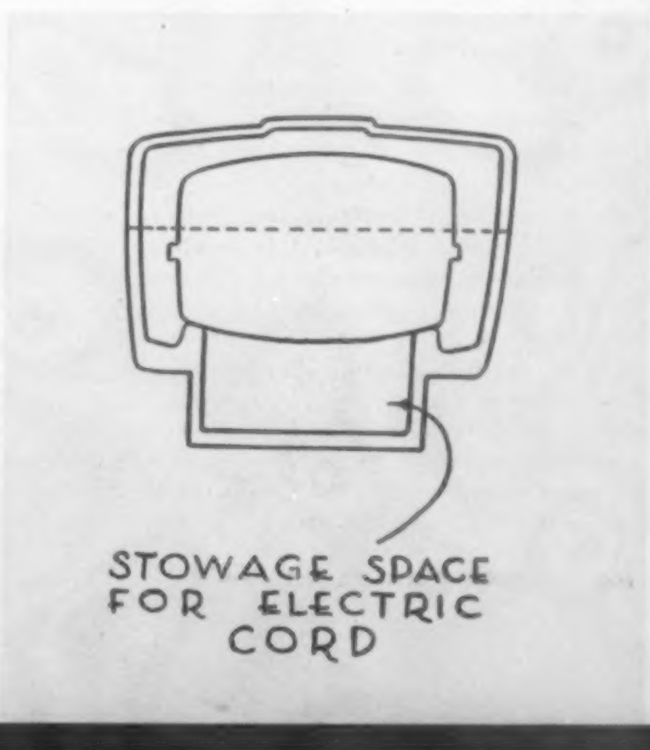
The average industrial designer is naturally strongest in his ability to conceive pleasing form, proportion, texture and color combinations. This is his primary contribution to the team of specialists that brings the finished product to the ultimate consumer. But eye appeal cannot compensate for costs that are prohibitive or for a design that is functionally poor. And, too, a designer must keep in mind the fact that eye appeal for a product which competes for attention on a department store counter must be of a different quality from the eye appeal of a product sold primarily through jewelry stores and more individually displayed. A product that retails for $10 cannot look as though it costs $5. These are only a few of the facts the designer should know. (*Please turn to next page*)

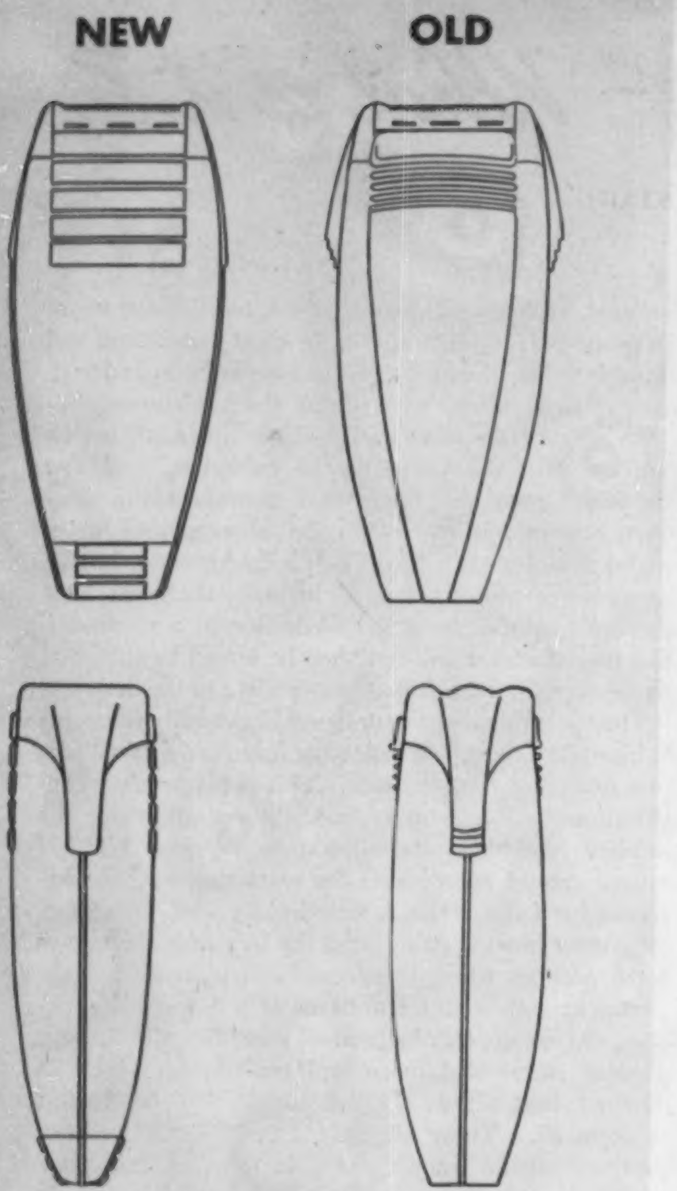
The ease with which an electric shaver can be held is shown in the accompanying sketch of a proposed design. Thumb cushions grip raised sections at both ends of unit

A cross-section of the razor case indicates its practicality for storing the electric cord and plug attachment and also the ease with which such a case can be produced

ALL DESIGNS AND DRAWINGS BY GERALD STAHL







A typical example of a prewar shaver (right) is contrasted to a suggested design which improves on appearance and ease of handling. Molding problems are also kept in mind

All this means that the designer should have a practical, analytical mind for research and observation so that he can perfect sales stimulating and superior function-in-use features upon which repeat sales are built. He must be able to develop features of utility and convenience and incorporate them into an attractive design. In most products, this involves a study of economy in motion, psychological reactions to form, arrangement and texture, and ease of handling.

Redesigning an electric shaver

The accompanying designs and diagrams illustrate a desirable approach to an industrial design problem. In this instance the die costs for the old electric shaver housing and the new design are the same, yet many features of utility, eye appeal and serviceability have been added in the suggested redesign. The designers' work was, of course, influenced by the fact that the product is sold in sufficient quantity to permit the amortization of the mold cost over a great number of parts—bringing the cost per housing to a negligibly low figure.

The plastic core is more compact and lighter in weight than the old metal and fabric box. This makes for cheaper bulk shipments of the product, and greater convenience of handling by the user. The feature of rapid stowage of the electric cord in the carton while it is still attached to the shaver housing, is an important one. A survey revealed that most users object to the successive steps involved in the removal of the shaver for use and its repacking. These steps are: 1) Removing the cord from the carton and disengaging the cord from its holder, 2) Unwinding the cord and inserting the female plug into the shaver housing, 3) Inserting the male plug at the power source and removal upon completion of the shave, 4) Disengaging the rubber female plug from the shaver (this involves a certain amount of difficulty because the rubber female plug usually binds in the socket), 5) Replacing the shaver, 6) Rewinding and restowing the electric cord.

The design of the new model reduces these 6 steps to the single action of plugging the unit into the power source. The electric cord and plug are a semi-permanent integral part of the housing; yet the cord can be easily replaced should it become worn out or broken. Its outstanding convenience is that it makes possible restowing of the shaver in its carton the simple action of winding the loose cord around the fingers for stowage with the shaver in its receptacle. In addition, the case is ideal for effective display of the shaver. The shaver itself has been reworked so that it is easier to grip and handle.

This abbreviated analysis of an approach to practical product design illustrates some of the factors of cost, eye appeal and serviceability that produces sales appeal. When these higher standards of design are more universally applied, the consumer will receive greater value for his purchase price and the manufacturer increased profits. These principles are obvious, but they cannot be achieved unless the designers have the advanced technical background in keeping with the complexities of modern manufacture and distribution. The designer must have more than an eye for pleasing form and a speaking acquaintance with manufacturing processes.

Industrial design, as a recognized profession, is still young. The results of proper background and experience are only beginning to supply sufficient designers who have the professional ability expected of the engineer, architect, chemist or lawyer. Until such time as there are enough professional designers to meet the demand, engineers, architects and artists can help. But the days of the jack-of-all-trades has passed; he no longer can hold his place on the team with other skilled specialists.

Sheet vinyl electrotype processing

SOMETHING of a revolution is quietly taking place in the printing industry. Perhaps its most active front is the huge plant of the Meredith Publishing Co. at which are printed *Better Homes and Gardens* and *Successful Farming*, as well as other publications.

This organization recently installed in its composing department a newly developed automatic sheet plastic molding press which effectively solves a number of serious production problems long associated with the printing and publishing field. Working in close cooperation with the Capital City Printing Plate Co., Meredith has long been a pioneer in the application of molded Vinylite sheet material to electrotype production. Issuance of the September 1946 issue of *Better Homes and Gardens* will mark the completion of a three-year period during which plates have been produced through the use of molded thermoplastic sheets.

According to Robert R. Myers, general manager of the printing plate company, the new press produces molds which are equal if not superior to the finest lead mold. The high degree of accuracy which must be maintained in the molding is indicated by the fact that in 133-line process color work there are some 70,000 dots per square inch of printed surface, which must be properly positioned to give the desired finished result. Half-tones and type matter can be reproduced by this method without any special patterns.

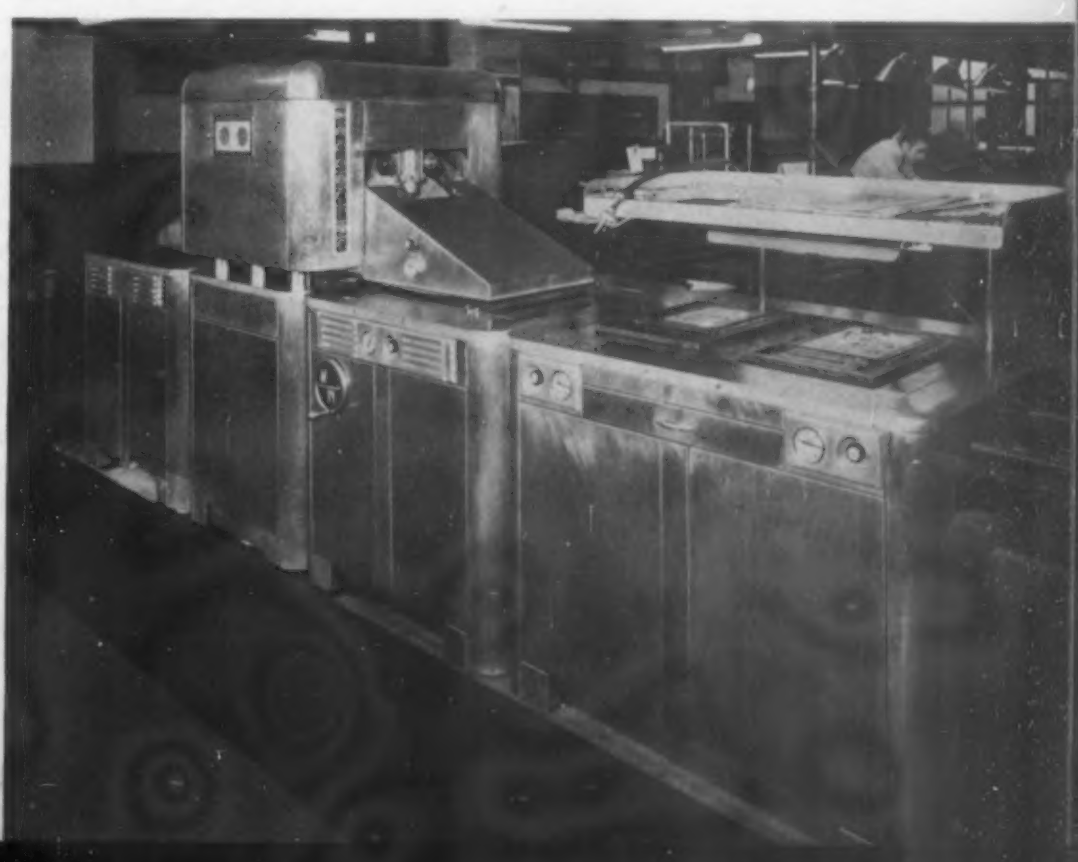
Reasons behind the development

Basic research work on the use of molded plastic sheets in electrotype production has been carried out in recent years at Battelle Institute under the sponsorship of Printing Plates Research, Inc., an organization established by electrotypers throughout the United States to work on the development of improved methods. The U. S. Government Printing Office was one of the earliest printing plants to use the new technique.

The traditional wax and impression lead molding methods employed in electrotype production possess a number of serious disadvantages which are completely eliminated in the new thermoplastic sheet process. For example, in working with wax or lead molds, it is necessary to make as many molds as there are electrotypes required, for the mold must be melted away and destroyed in order to release the electrotype. In many cases, this necessitates holding the original type forms for possible later use and results in the accumulation of large quantities of space-consuming type forms.

In contrast, formed plastic sheets used in the making of electrotypes may be run through the various operations a number of times, permitting the original type forms to be broken up as soon as the page impression has been molded into the vinyl material. The officials of the printing plate company report the production of as many as nine successful duplicate shells from a single vinyl molding.

One of the most dramatic advantages of the new method is the fact that the plastic sheets from which electrotypes for an entire magazine or book are produced can be neatly filed in a single drawer. Flat and conveniently available for future use, they are a far cry from the tons of dust-collecting type forms which would have to be stored under the old system to main-



View of the molding press in which vinyl sheet is pressed over page forms. The two page forms at right are being preheated. From this position they are carried by conveyor to wedge-shaped press at left

The vinyl sheet is carefully placed on the page form. Controls at left regulate heat platen, press and conveyor

After the cooling platen has been raised, the molded sheet is stripped from the type. Form moves automatically beneath the cooling platen at the end of the molding cycle

The molded thermoplastic form is sprayed with a silver solution preparatory to the electrolytic deposition of layers of nickel and copper to form the electrotype shell

tain equivalent control over future printing activities.

Wax and impression lead molding, involving the handling of large quantities of powdered graphite, are notably dirty and unpleasant operations. With the sheet plastic method, such operations are eliminated, producing a striking change in the appearance of the shop and greatly improving employee appearance and morale. This element of cleanliness carries throughout the useful life of the plastic page forms. Never used themselves in the final printing process, the vinyl sheets remain clean to handle and require no processing before being filed.

Still another production economy lies in the fact that when the value of holding the plastic mold has passed the stage of usefulness, this same material, without further preparation other than surface cleaning, can be placed on another subject as if it were a new plastic sheet. This shows the flexibility of the material and affords great economy by lessening the amount of plastic sheets that it is necessary to purchase.

The press for molding the plates

The new plastic molding press and all other units necessary to processing the plastic were developed and manufactured by the Monomelt Co., Inc. The press is the first of a series of this design now in production. Made expressly for the plastic molding system, with whose progress this firm has been closely identified, the stainless steel unit automatically conveys the type forms through the molding operation. It is provided with control of temperature, pressure and other variables in order to produce more uniformity of results.

The press unit is controlled electrically and incorporates a hydraulic molding stage. Preheating and cooling stages are operated by a combination of an air valve and a spring mechanism. The timers control the intervals on the preheating stage and the molding stage, and can be set in seconds from 1 sec. to 5 minutes. For the average form, 1 to $1^1/_2$ min. in each stage is adequate time. The plastic molds used between 190 and 220° F. Temperature controls on the press unit are set to attain this temperature.

Here are the essential operations involved in producing an electrotype with the new press:

1. The locked-up page form is preheated to approximately 200° F. The preheater section of the press can accommodate several standard size pages at once.

2. The page form, cleaned of dust with an air line, is placed on a conveyor assembly which will move it directly into the press. The sheet of 0.030-in. vinyl sheeting (20 by 50 in.) slightly over page size, is laid on the heated form.

3. Pressing of a control button starts the conveyor and causes the form to move into the molding press where it is subjected to the required temperature and pressure for a brief period. A heat-resisting synthetic molding blanket controls the depth of the impression. Molding pressure varies somewhat from 50 to 600 p.s.i., according to the nature of the work. The automatic

conveyor always centers the "sandwich," eliminating any possibility of rocking the ram.

4. After the molding operation, the form is automatically ejected from the press and moves beneath a cooling platen, where it remains until the platen is raised by push button control and the thermoplastic sheet lifted off the type form. No graphite or releasing agent is required. This is the end of the molding stage.

5. The molded plastic sheet, faithfully reproducing all type, illustrations and other matter on the original page, is washed and then sensitized with a solution of stannous chloride, applied by spraying or flooding. This is followed by a clear water rinse.

6. The sheet is transferred to a stopping-off rack and sprayed with silver solution, after which a thin strip of lead or copper is stapled to the base of the silvered mold to provide an electrical connection.

7. Two of the sheets are placed back to back, held together by rubber channels and hung in plating vats.

8. Suspended in the vats, the molds receive a deposit of nickel varying from 0.001 to 0.002 in. thick. They are then transferred to another section of the vat for the deposition of a copper shell ranging from 0.008 to 0.012 in. thick, depending on the individual printing requirements. The complete plating process runs from $2^1/_2$ to around 4 hours.

9. Plated molds are laid on a perforated rubber blanket where a vacuum firmly holds down the copper shell while the plastic form is stripped off by hand, releasing it for another electrotyping cycle or for filing. From this point on, the copper shell is trimmed, finished and mounted in the same manner as are electrotypes made by the old method.

Prior to the installation of the new plastic molding press, the Meredith Publishing Co. first locked up its page forms and then trucked them a short distance to the plant of the Capital City Printing Plate Co. for the molding of the vinyl resin sheets and the subsequent electrotyping operations. Then the original type forms were trucked back to the printing plant. This procedure necessitated the lifting and handling of a heavy tonnage of type metal each month and the subjection of the forms to numerous shocks in transit.

So simple in operation is the new press, however, that it is installed directly in the company's composing room. Now the publishing firm can make the vinyl impression of a page as soon as it is ready, send the lightweight plastic forms to the electrotyping firm for subsequent operations and dismantle the original type forms at once. This also effects savings.

The handling of reprints emphasizes the advantages to be gained from adoption of the plastic molding method. One large material list project issued by the publishing firm involved 108 forms measuring 19 by 22 inches. This job would have imposed a staggering storage problem had it been necessary to keep the original type forms. With the plastic sheet method, it was reduced to a routine filing operation. An idea of the metal involved in a typical Meredith booklet may be gained from the 1946 edition of *New Ideas for Building Your Home*. Type pages for this volume, measuring 9 by 12 in., weighed 35 lb. each for a total of 7280 lb., or more than $3^1/_2$ tons. Transferred to the thermoplastic sheets, the same type matter weighs only a few pounds.

The silver-coated plastic sheet is placed in plating vats

Last operation is the stripping of vinyl form from copper shell. This shell is then finished and mounted the same way as electrotypes made by wax or impression molding

Thus in the field of electrotyping, plastics are bringing a new standard of perfection and efficiency to a long-established production process—not as substitute materials but because their special properties permit the adoption of modern methods not previously attainable. And it is interesting to note that the special press developed for this work has wide possibilities for the processing of sheet plastic in the novelty and game field, as well as for electrical assembly work involving intricate wiring patterns.

The exterior walls and roof of this 5-room house are made from aluminum skinned expanded panels having a core of resin impregnated paper

The other side of the sandwich panel forms the interior house walls. They may be painted or papered to fit in with any desired decoration

Structural plastics in low-cost housing

The light weight and strength of this material is attributable to the design of the resin impregnated paper core

A RECENT release from the National Housing Agency points to a promising array of new building materials which are being developed by private industry and are expected to result in the construction of many new homes under the Veterans Emergency Housing Program. Mr. Wilson W. Wyatt, in his release, states that "While utilizing all possible means to expand production of traditional materials, we are also encouraging the full development of new materials."

In this release, great stress is placed on what Mr. Wyatt indicates to be an outstanding example of the material for building. This is a single thickness panel consisting of an expanded plastic core with aluminum faces. It is stated that the material has good insulation qualities and high strength, yet weighs less than one-half as much as cork. This material, developed for housing by Lincoln Industries, Inc., has to date been used in the construction of five houses, some consisting of four and five rooms and others of nine rooms.

The materials of construction

Figure 1 shows an exterior of the five-room house in which the walls and roof are made from panels of aluminum skinned expanded plastic material. Standardized wall panels used in the construction are 2 in. thick, roof panels 3 in. thick and the core is made of Kraft paper impregnated with a plastic resin. The cells of the core are bonded to aluminum skins.

The foundation of the houses are cinder blocks which support a reinforced concrete floor. The panels are securely affixed to this foundation by means of screws, a method of attachment that is also used to tie the panels to each other. In order to facilitate this operation, the sandwich panels are produced with flanges which permit a secure and permanent assembly. Due to the light weight of this building material, it is possible for the walls themselves to carry the weight of the roof and panels. Not only does this honeycomb structure give the great strength required in building construction, but it also acts as a very efficient insulation material. The unpainted aluminum skin on the roof tends to deflect the heat of the sun and, in this way, adds to the cooling qualities of this structure.

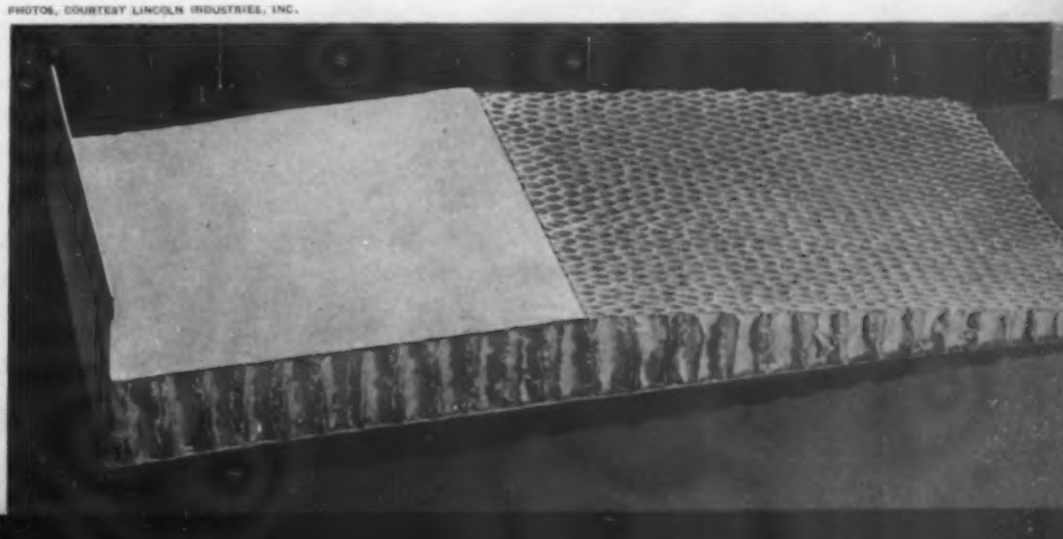
At the moment, the Lincoln brothers estimate that they will be able to retail a four-room model constructed in the manner and with the materials described above for approximately $3000. This figure will include the cost of kitchen and bathroom equipment only. They are experimenting with an oil burning space heater which will be installed beneath the floor. Although no cellar is provided, the earth which is enclosed by the foundation will be covered by an insulated paper. This chamber beneath the house will then become the heating chamber which will not only warm the floors of the house but will also permit circulation of hot air through properly located grills in the floor.

Although the exact composition of the honeycomb and skins has not been chosen as yet, it appears that with minor modifications, the kraft paper and aluminum materials will be used for production. J. D. Lincoln states that any but a water-soluble synthetic resin should be acceptable for the job. Of even greater interest is the fact that production work is now going forward on equipment which will produce the expanded plastic panel on a highly mechanized conveyor line.

Building code a stumbling block

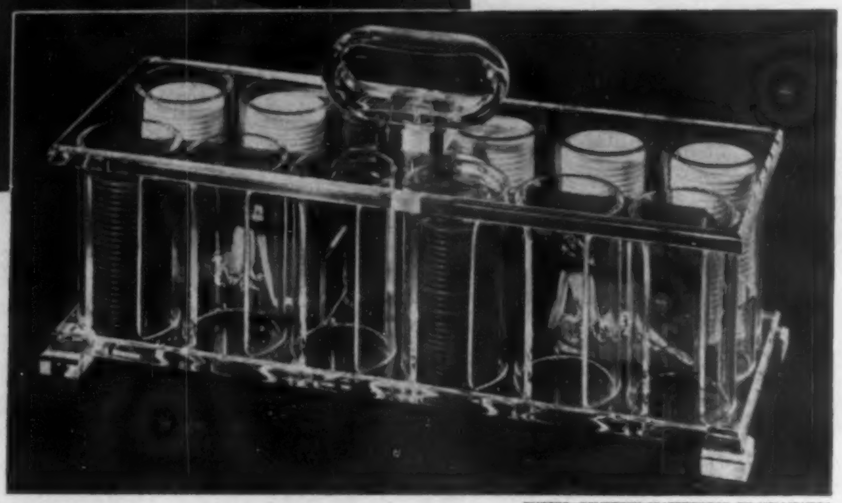
The biggest problem in this entire situation has to do with antiquated building codes which are based on conventional materials. These codes require a certain wall thickness regardless of the strength of the material. But both of these problems are being tackled as a vital part of the Veterans Emergency Housing program and it is hoped they will meet with success.

PHOTOS, COURTESY LINCOLN INDUSTRIES, INC.



A cross-section of the expanded plastic honeycomb reveals its construction and the reason for its light weight. Wall panels come in 2-in. thick panels; roofing is 3 in. thick

The heavy gage acrylic materials used for these display shelves and occasional tables are important both from the functional angle and from the point of view of unfailing performance and appearance



Function, appearance and production are all well served by the transparent acrylic materials used for this poker chip rack. The chips themselves are molded in bright and vari-colored urea

PHOTOS, COURTESY SCATTERGOOD OF HOLLYWOOD

Tailoring the product to the material

A BALANCING of function, design and material. This is the formula upon which Don J. Smith (Scattergood of Hollywood) has built his line of men's accessories and display fixtures, using Lucite or Plexiglas.

How well this system works to produce attractive, salable merchandise is perhaps best displayed in his poker chip racks, one of which is illustrated above. From the functional point of view, the crystal clarity of the acrylic material makes for ease in counting the chips. As for eye appeal, the bright colors of the poker chips are complimented and enhanced by the transparency of the acrylics. And, with all this, the plastic lends itself to the fabrication of a wide variety of shapes and designs.

With one exception, the same basic structural features are employed in the fabrication of all the racks. Chip compartments are formed into $^3/_4$ cylinders and set vertically on the base. Open sections match the outer edge for ease in removing or replacing the chips.

For convenience in carrying, each rack is equipped with a fabricated easy-to-grip acrylic handle and flat cover of the same material. A hole is drilled through the center of the cover to allow it to pass over the top of a $^1/_2$-in. nickel plated brass rod threaded with S.A.E. threads to screw into a jam nut attached to the bottom plate of the rack. The upper end of the rod is threaded with standard threads to accommodate the handle. All surfaces and edges are wet sanded, buffed and polished, a procedure which contributes to the clear qualities of the finished product.

Like all Don Smith's articles, the racks are fabricated almost entirely of heavy gage acrylic material. This has definite structural advantages. For example, tests reveal that the broad joint surfaces contributed by the heavy gage material combined with the cementing material create joints which are stronger than the acrylic itself. This is particularly important in the display shelves and tables produced by this company and shown above.

Poker chips, compression molded of either Beetle or Plaskon, are another line produced by this company.

Plastics Products*

FASHION

Flatterer to milady's vanity is a 3-piece Lucite dresser set, delicately silver plated. Metaltex Products Co., who fabricate and distribute the set, uses solid pieces of methyl methacrylate in each piece. After flowers are carved, the parts to be silver plated are dipped in a chemical solution, a copper plating, soaked again in a chemical solution and then silver plated. The process discourages tarnishing

Attractive show cases, these Vuepak hat boxes with laminated printed fabric covers! Plastic Artisans, Inc., makes them using a special bead-edging process to eliminate cementing in bottoms and tops

With the triple appeal of beauty, convenience and utility, the Trio-ette combination hand mirror, compact and lipstick enjoys ready acceptance by feminine admirers. Plastic components are injection molded in ebony, ivory, blue, green, rose and carnelian, for the House of Platé, who assemble and distribute the product

Unraveler of many a knotty problem is this smooth, snag-proof bodkin. It has tapered ribs to open hems and a double V locking eyelet to prevent unthreading. Plastic Die & Tool Corp. mold the bodkin of Tenite II

Home Decoration

Cocktails for two can be served with intrigue at this delightful roundtable. The laminated Textolite base has electrical apparatus installed within, making it possible to get attractive lighting effects—both through the plastic base and the top. The sturdy 24-in. diameter base keeps the table from tipping and firmly holds the huge plate glass top. William B. Petzold designed the table for the Plastics Division of the General Electric Co.

No more fumbling for the troublesome catch on your cigarette case if it has the featured "Slip-Top." The acetate parts are molded by Plastic Die & Tool Corp. for Plastic Molded Products, Inc. Available in several colors, the case holds regular or king-sized packs

An optical illusion would make you believe that this lamp has no more substantial base than bubbles apparently suspended in air. Actually, the plastic shade is fitted to a base fashioned from two blocks of specially cast Lustron. Real leaves are cemented between two sheets of matte-finish Fibestos to make an attractive shade. Mary Adler designed this shade which is manufactured and sold by the Floral Shade Co.

A guiding light for bedroom, child's room or hospital room is this illuminated Crucifix designed for the Plastics Mfg. Co. by Sundberg-Ferar. The Corpus, impressed into the back of the Lucite cross and finished in gold leaf, is lighted by a 6-watt bulb set in the rear of the phenolic base. When this lamp is turned on the light-carrying characteristics of the methyl methacrylate cause a soft halo to glow around the figure. The initials INRI, above the head, also catch some of the lighting

In a very hospitable manner, the "Have A Smoke" combination cigarette holder and ash tray offers a cigarette to anyone opening it. The top compartment holds about 20 cigarettes and as it is lifted one cigarette drops into a slot where it is immediately accessible. The lower compartment is an ash tray and contains an extra, detachable tray—all of which makes the Specialty Mfg. Company's product a very handy item. Bakelite was chosen as the plastic material chiefly because of its ability to withstand variations in temperature. The six parts that compose this unit are molded in a 12-cavity mold. When assembled they fit closely and work easily

Decals make a delicate decor for a Plexiglas boudoir hassock. Ladies of leisure will appreciate the luxury item which is formed with a sturdy acrylic base and topped by a huge cushion. The Decals, sold by Meyercord Co. are permanent and can be washed with soap and water

Metal tools and parts often deteriorate from rust and corrosion before they reach the end user. To eliminate the danger of this happening during storage and shipping periods, Paisley Products, Inc., has developed a coating called Plastic Peel. Produced from Hercules ethyl cellulose, the coating is applied by dipping the part into the solution while hot. The coating which is resistant to weather extremes, alkalis and chemicals, is transparent and adheres until it is peeled off

Plexiglas, which did such a good job during the war as bomber nose and gun turret material, is now being tried for many new industrial purposes. The Byers Machine Co. claims to have found a good application for the acrylic—a cab window for their mobile dirt shovel. They have found the window easy to install, as transparent as plate glass and unaffected by vibration. It will also withstand heavy impact blows. The cab enclosure is equipped with a special vision window in the roof

High intermittent pressures which were responsible for rapid deterioration of conventional tubings used on boring machines made by B. M. Root Co. have no effect upon the Resistoflex compar tubings that now replace them. The polyvinyl alcohol resin tubing has made better production schedules possible for the woodworking and allied industries

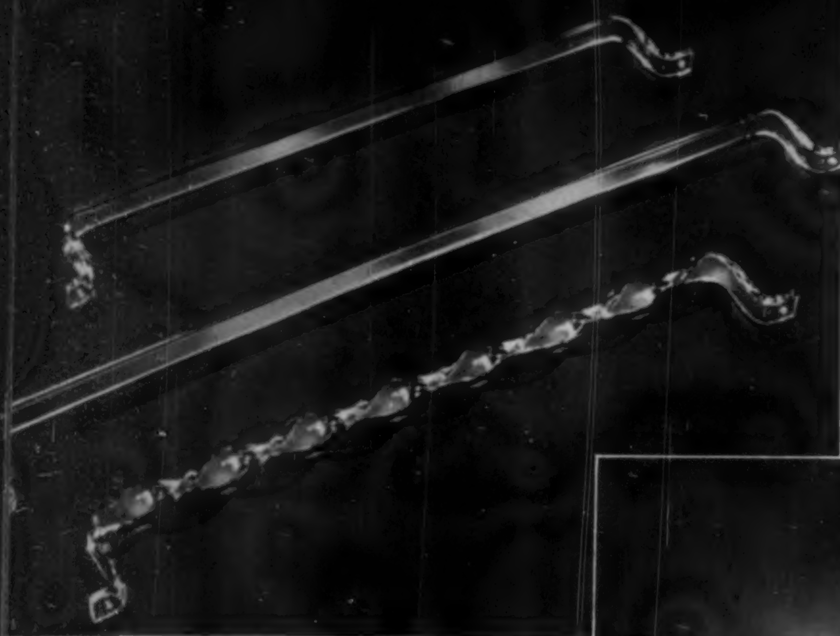
APPLICATIONS

Factories, mines and aircraft with vexing ventilation problems should investigate Spiratube made by Warner Bros. Co. The duck tube is coated with Neoprene latex—rendering it strong, flexible, flameproof and resistant to chemicals. An inner helix spring holds the tube firmly during suction and pressure operations

Signs of the times are now made of a Lucite luminescent sheeting. A luminescent pigment incorporated in the material causes the signs to glow in the dark 12 hr. after electric lights are extinguished. This material, now being produced on a small scale, should prove popular for directional signs

Eye-Gard Lift Front goggles protect the forehead as well as the eyes of busy industrial workers. Molded lens-holding parts are Tenite and the head gear utilizes a resin impregnated fabric. All parts are adjustable for comfort. Watertown Mfg. Co. does the molding for American Industrial Safety Equipment Co.

Exploring the ocean depths has been considerably simplified by a sea-going tape measure. Product of Neptune Specialties Co., it consists of a hemp rope marked at every fathom with white Vinylite strips printed with a red figure that indicates depth. Every fifth fathom the colors of strips are reversed

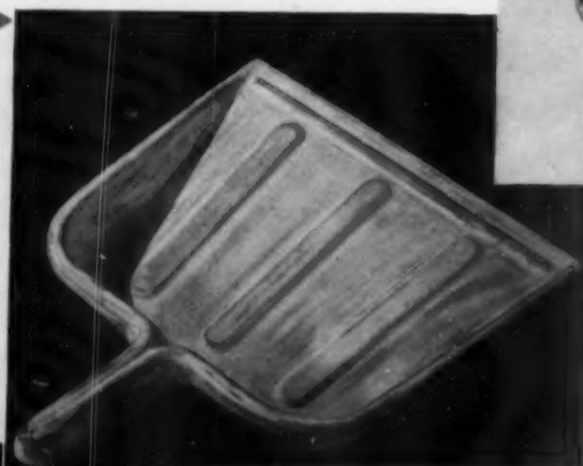


As bathrooms ceased to be a stepchild of the house and became a glamorous household member, plastics stepped into the picture to help in the reconversion. Among the new bathroom luxury items are Plexiglas towel racks, made by Plastic Protecto, that are easily kept sparklingly clean. They come in a variety of colors

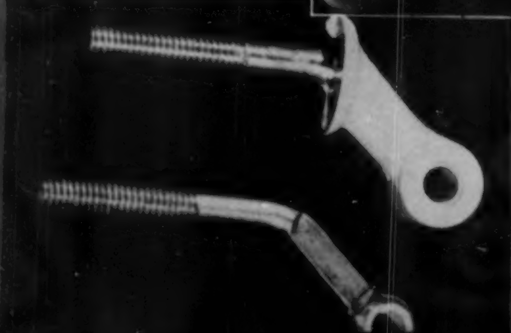
For a pleasant evening of bridge, free from petty worries and annoyances, the smart hostess will choose San Duro trays. Injection molded of Styron by Eclipse Moulded Products Co., the trays have a smooth surface resistant to fruit acids, alcohol, hot water

HOME UTILITY

Making a clean sweep with a plastic dust pan is a real pleasure. This new pan, being produced experimentally of glass fabric impregnated with Bakelite polyester resins, makes use of the low pressure laminating technique



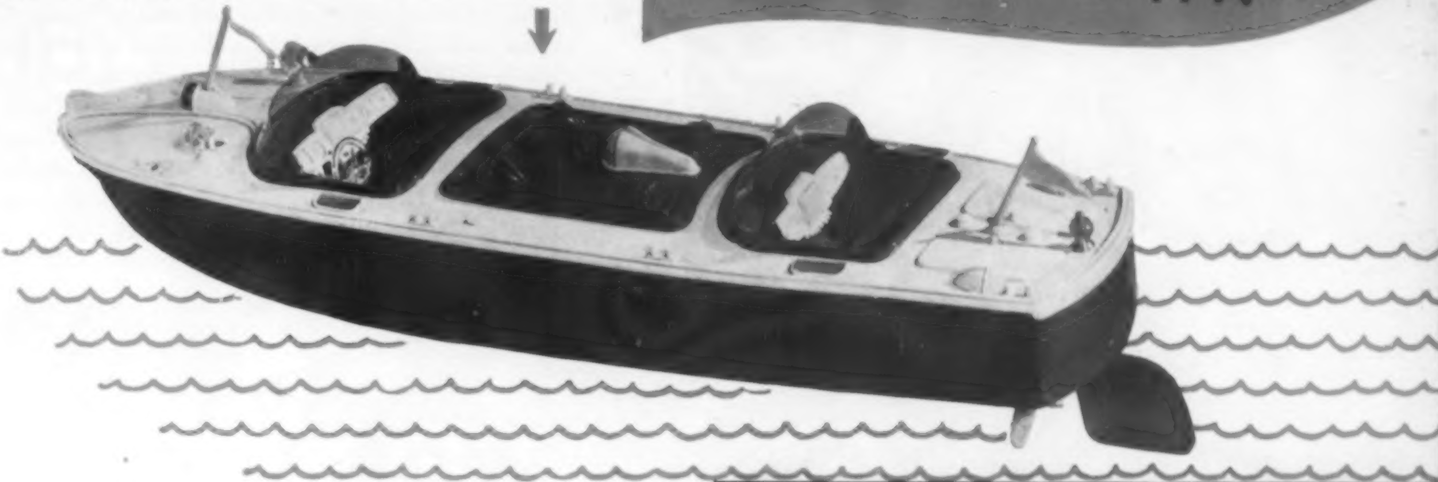
Boiled right down to it, a teakettle with a Bakelite handle is good insurance against burned hands. Barber-Colman Co. molds the parts for West Bend Aluminum Co.



Overcoming material shortages in making toilet seat hinges, C. F. Church Mfg.Co.press a plastic bushing into steel hinge body pivot, locating piece as a mold insert. Tenite II is molded on the outside

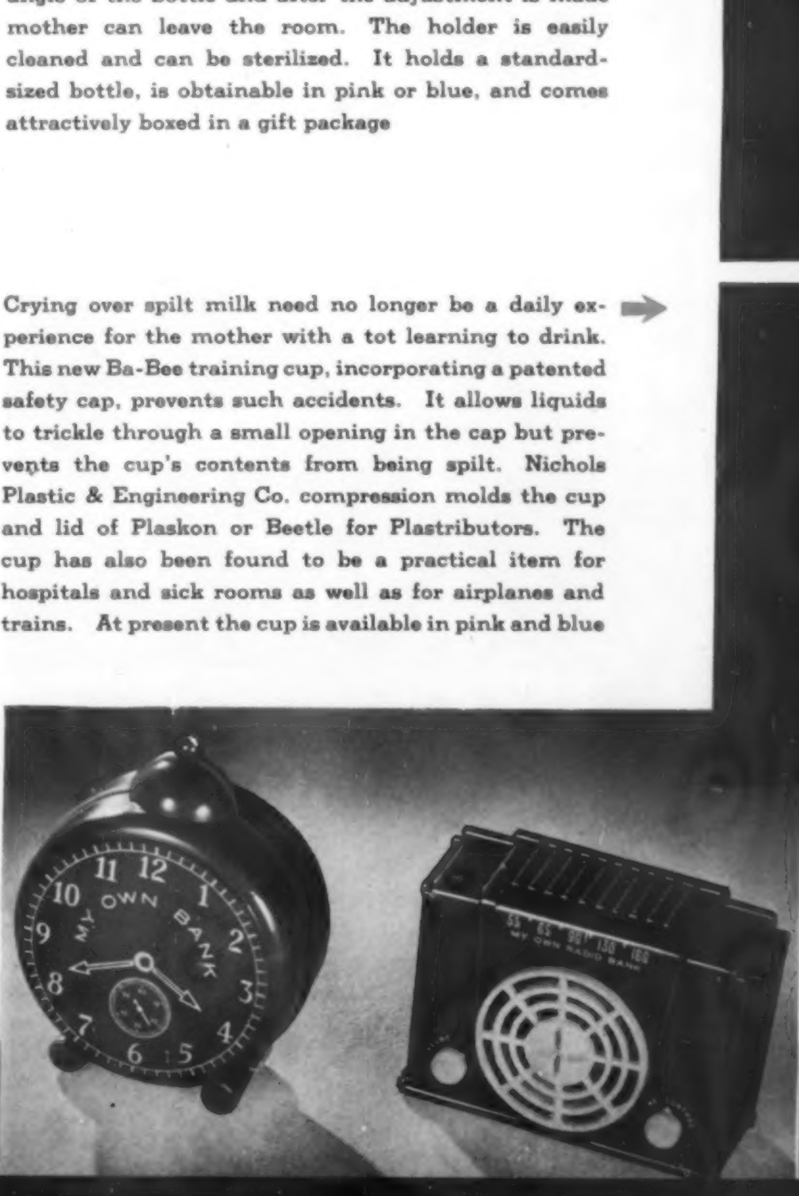
JUVENILE MARKET

Envy of all the gang is this Harcraft Products speedboat. The hull and deck are molded of blue and white polystyrene powder, respectively. Windshields are clear Tenite II, interior trim is acetate, and running lights are Lucite. She runs 4 m.p.h.



Mother's little helper, and baby's too, is a bottle holder that makes feeding time a lot simpler. The F. A. Murphy Co. molds the holder of Tenite II—a material it chose because of rapid flow, high weld quality. The holder is held in place by tying ribbons around the pillow under baby's head. Ribbons also adjust the angle of the bottle and after the adjustment is made mother can leave the room. The holder is easily cleaned and can be sterilized. It holds a standard-sized bottle, is obtainable in pink or blue, and comes attractively boxed in a gift package

Crying over spilt milk need no longer be a daily experience for the mother with a tot learning to drink. This new Ba-Bee training cup, incorporating a patented safety cap, prevents such accidents. It allows liquids to trickle through a small opening in the cap but prevents the cup's contents from being spilt. Nichols Plastic & Engineering Co. compression molds the cup and lid of Plaskon or Beetle for Plastributors. The cup has also been found to be a practical item for hospitals and sick rooms as well as for airplanes and trains. At present the cup is available in pink and blue



"A penny saved is a penny got"—good advice to children. Molded of cellulose acetate or ethyl cellulose, banks are sturdy, attractively duplicate alarm clock and radio. Ardee Plastics Co.,Inc., molds and distributes them

PLAYTIME PLASTICS

The eyes have it—little matter how small the object viewed—when using streamlined sport binoculars (foreground). They consist of 4 parts molded of cellulose acetate in 2 molds. Columbia Protektosite Co., Inc., molds binoculars and effected considerable saving in cost and labor over its former model (background) which had 14 parts produced in 9 molds

The world at their finger tips! The lightweight globe utilizes the Lap-Ply process. Developed by the Casein Co. of America, the process calls for over-lapping thin layers of resin-coated veneer around a mold, inserting unit in a rubber case, drawing a vacuum, heating and allowing it to set

According to its name, the Hotter 'N 'Ell fish lure should be a good one. Injection molded of Tenite, it is marketed by Martin Fish Lure Co. Live bait is partially inserted in transparent case held there by wires. The wriggling bait attracts bigger game

The "Little Jewel" home radio, a Westinghouse Electric Corp. product, employs 6 different plastic materials. The pastel colored side pieces are molded of Durez by Chicago Die Mold Co., the control knobs and handle grips of Lumarith by Rohden Mfg. Co. and Modern Plastics Corp., bottom insulating plate of linen-base Bakelite by Continental Diamond Fibre Co., dial face of Vinylite is printed by J. B. Carroll Co., and the colored Plexiglas jewels are molded by Auburn Button Works, Inc.

Soundproofing with plastics

HERE'S one for Ripley's Believe It or Not: The quietest room in all Chicago—and, incidentally, one of the quietest anywhere in the world—is located in a heavily populated area on the city's South Side, only a stone's throw from the clatter of street cars and the roar of elevated trains.

It's an unconventionally constructed room, just completed at the Illinois Institute of Technology, in which advanced research work will be conducted for the prevention and alleviation of human deafness. And its ability to block out exterior noises, as well as to soak up internal sounds with barely a ghost of an echo, results from the use of approximately two tons of Fiberglas preformed wool, impregnated with phenolic resin in the percentage needed for required density and shaped into sound-absorbing wedges that line walls, floor and ceiling.

The "anechoic chamber," as it is called in scientific terminology, is housed in a special building erected on the Illinois Tech campus by the Parmly Foundation for Auditory Research. The soundproof room, patterned after installations developed by Dr. Leo L. Beranek at Harvard University during the war, was finished early in April 1946.

Interior dimensions of the completed room are 15 by 12 by $6^1/_2$ ft. high. The entire interior of the chamber, including the floor, is studded with wedges of resin impregnated glass fiber measuring 8 in. square at the base and 24 in. from base to tip. The room contains approximately 2500 of these wedges, which were fabricated on the site. According to Prof. Peter J. Mills, director of the Parmly Foundation, who designed and directed construction of the room, glass fiber preformed wool proved to be an ideal sound absorbing material for the anechoic chamber because it is available in a wide range of densities and flow resistances, could be obtained in convenient sizes, is easy to fabricate with simple equipment and offered uniform density.

The weight of the entire chamber is approximately 40 tons. In order to isolate it effectively from the building in which it is housed, the room is supported at each corner by Neoprene pads. An air gap of approximately 2 ft. surrounds this floating room, which is built within a concrete chamber insulated with 2-in. slabs of the impregnated glass fiber wool.

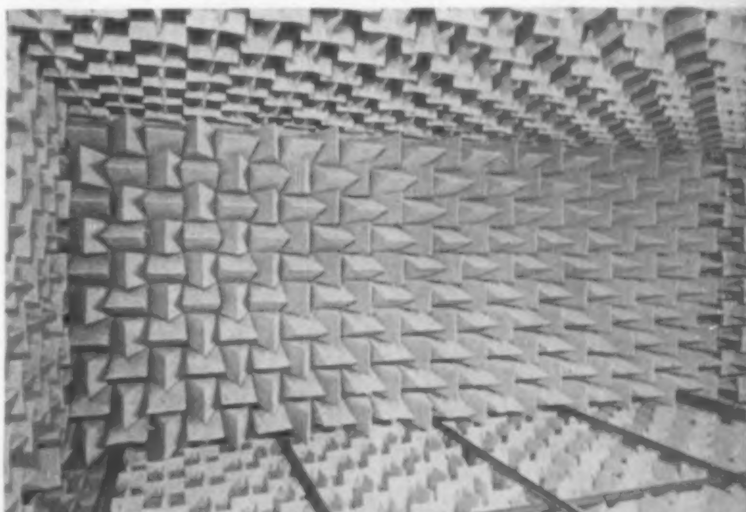
Making the sound-deadening wedges

The specially shaped wedges lining the interior of the acoustical chamber were made by taking batts of the phenolic resin impregnated glass fiber, measuring 4 by 24 by 48 in., and cutting them in a jig to 4 by 8 by 24 inches. Slabs of this size, having a density of 3.25 lb. per cu. ft., were then placed in a slitting jig and a diagonal saw cut was made. The two resulting pieces were next placed upright on a square slab of slightly denser material and a shaped muslin bag was pulled in place over them. The wedge was completed by placing an open wooden frame on the bottom of the assembly, pulling the cloth up tightly and fastening it to the frame by means of a stapling gun. Thus the pressure of the cloth bag held the wooden base firmly to the bottom of the wedge.

In installation, the lightweight wedges were screwed directly to a wooden framework built over the Sheetrock walls of the chamber, allowance being made in the dimensions so that the wedges would fit closely together for best acoustical results and alternate in position.

According to Prof. Mills, the anechoic chamber was designed to have 99 percent sound absorption at 115 cycles per second and 99.9 percent absorption at 150 cycles or higher.

Interior view of soundproof room shows acoustical wedges formed of phenolic resin-impregnated glass fiber wool



Making glass fiber wedges, center worker cuts form with a band saw. Man at right puts muslin bag over finished unit

Furfural resins are finding a new outlet as binders for glass fibers in storage battery retainer mats

Advances in furfural resin applications

Because of their dark color and resistance to a variety of influences, furfural resins are used chiefly in practical items

A MAJOR advantage of the chemical furfural introduced commercially in 1922 by the Quaker Oats Co., is its reactivity, which makes for extreme versatility. Although only a small fraction of total volume is consumed by the plastics industry, there is every indication that synthetic resins deriving from either furfural or furfuryl alcohol are likely to play an increasingly important role in the plastics industry.

This article will not attempt to discuss the already well-known furfural resin adhesives developed at the Plastics Industries Technical Institute, nor the phenol-furfural resins which form the bases for the familiar Durite molding compounds. It will be confined to applications which are comparatively little known and some which have not yet been placed on the market.

Glass fiber mat impregnation

Pipe wrap—The underground pipe wrap is the latest development in the use of glass fiber mats bound with furfural. In roll form, the mat is employed to protect oil, gas and other pipelines against corrosion and electrolytic action. It can be wrapped around bitumen or coal tar coated pipe, thus forming a continuous, water-tight bond. Tensile strength is preserved through a wide range of temperature and exposure to organic solvents and soil acids. The wrap serves as a carrier for the asphalt bitumen coating, the millions of fine intertwined glass fibers reinforcing the coating to a much greater extent than do other carriers. The coating can be fully impregnated into the wrap.

The mat may be applied with the bond over the bare pipe and then coated, or may be bonded to the pipe by a preliminary coating applied directly on the pipe. The 0.015-in. furfural-bonded mat, recommended for most applications, shows breaking strengths ranging from 31.2 to 44.3 p.s.i. at 72° F., and from 19.9 to 30.4 p.s.i. at 130° F. Dielectric strength ranges from 710 to 345 volts per mil, depending on the percentage of binder.

Air conditioning—Glass fiber-furfural mats also are used in many air filtration and air conditioning applications, showing air permeability ranging from 0.040 to 0.430 for 0.015-in. thicknesses, depending on whether air flow in cubic feet per minute per square foot is 100 or 700, respectively.

Retainer mats—Fiberglas retainer mats have been found to improve the performance of modern storage batteries at a very low cost. The mat is a highly porous sheet that indefinitely withstands immersion in battery acid and retards the shedding of active material from the positive plates of the battery, thus prolonging battery life. The mats, held on either side of each positive plate, act as filters which let acid reach the active ma-

terial but keep this material from becoming dislodged.

Tests conducted by the V. L. Smithers Laboratories under S.A.E. test conditions showed that batteries equipped with glass fiber retainer mats recorded a cycling life up to 182 percent greater than those of identical batteries without mats, and showed improvement in cold starting throughout artificial aging tests. The mats also retard separator deterioration, sediment formation and negative growth formation.

A furfuraldehyde derivative

A significant turn in furfural applications has been taken by U. S. Stoneware Co., with the development of the Duralon[1] series of thermosetting resins. The resin, which is derived from furfuraldehyde, has the advantage of uniformity in quality and stability during long periods of storage. It may be used as a casting resin, as an adhesive for porous surfaces and for laminating plywoods, impregnation and surface coating. In all cases, the resin must be properly blended with the activator, which governs the extent and speed of cure. In solid cured form it can be easily machined.

Perhaps the resin's foremost chemical property is its ability to resist solution in contact with all common organic solvents. The top temperature range lies between 275 and 325° F.

As a surface coating, and as a casting and laminating resin, the resin is well adapted to electrical applications. Breakdown voltages have been in excess of 1000 volts per mil after 24 hr. immersion at room temperature.

During its cure, the resin goes through a rubbery stage, which allows it to be removed from the mold and heated to obtain the final cure. With the casting removed from the mold, the mold is freed for other work. Plaster molds may be used, or rubber and latex molds whenever an undercut must be reproduced. Shrinkage of the partially cured resin is less than 0.005 in. per in., thus creating a parting problem, which can be solved by using a thin coating of a low-melting wax, removable with an organic solvent.

As a laminating resin, the material does not produce any volatile by-products during its cure. Since it is a liquid with controllable viscosity, it penetrates materials easily without solvents or diluents. The peculiar wetting property of the resin also aids in laminating, making possible the use of heat and low pressure.

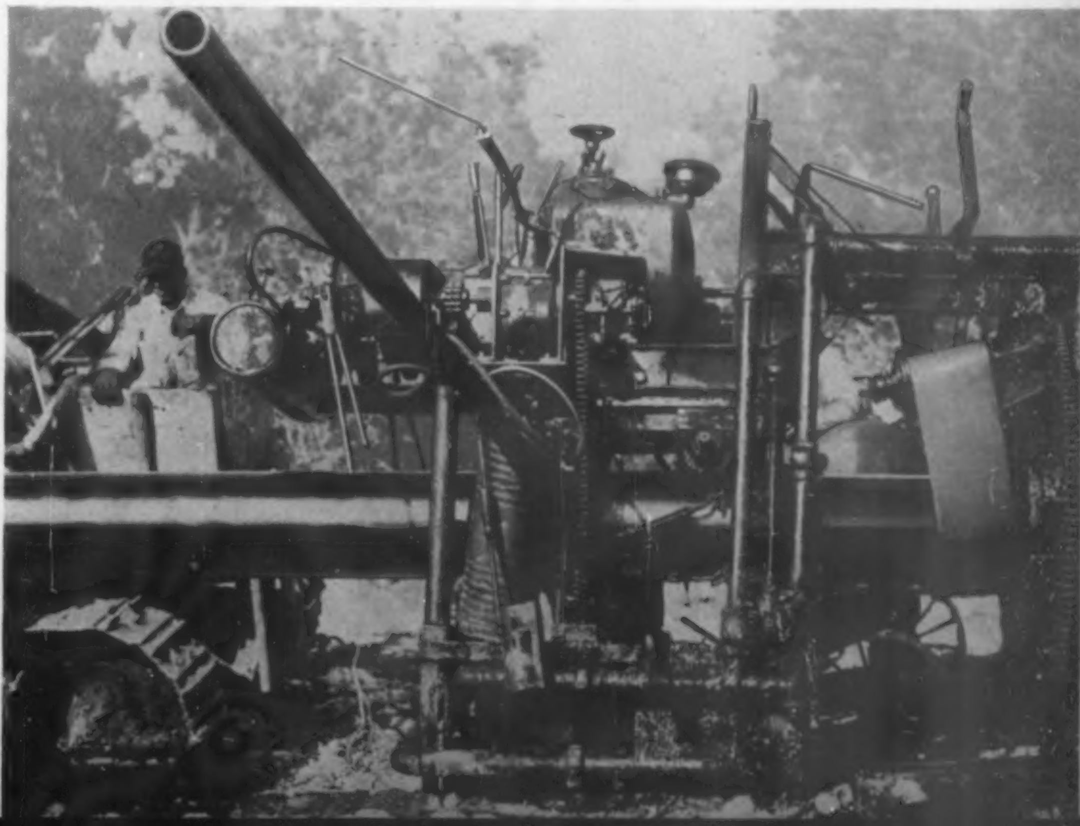
The resin may also be used to impregnate plaster of Paris, silicas, sandstone, low-density woods and other materials. It is compatible with most synthetic rubbers and thermosetting and thermoplastic resins, with or without a supporting plasticizer.

As an adhesive, the use of the resin is limited at present to surfaces having flexib lity and porosity—fabrics, woods, leather and similar materials, for example, which may thus be adhered to each other. The bonds formed have high tensile strength but low impact resistance.

Furane resin cement—An equally interesting corollary development is a furane-resin cement based on Duralon that is resistant to most inorganic and organic acids, alkalies, oils and solvents; a cement with high compressive and tensile strengths, and a temperature range to 375° F. Known as Durisite, this cement is marked by extreme density and can be used as a mortar for acid-proof masonry in tank linings, floors, sewers, towers and for other installations handling acids and alkalies alternately. A 100 percent resin with no solvents added, it can be stored indefinitely before mixing without deterioration. Absorption is less than 0.5 percent, and it is claimed that age and temperature do not increase porosity.

Though affected by high concentrations of highly oxidizing acids, the cement is non-toxic, non-explosive and non-flammable. Compressive strength is 12,000 p.s.i.; tensile strength over 1400 p.s.i.; modulus of rupture 1500 p.s.i. when fully cured; adhesion four to five

[1] Bulletins R-1, R-3, R-3A, R-5 and R-7, U. S. Stoneware Co.



Here a furane impregnated glass fiber wrap is being applied to an under ground pipe to serve as a carrier for the asphalt-bitumen coating required to prevent corrosion of metallic pipe on a Texas oil line

times that of silicate cements. The weight is 92 pcf, and the color black.

Surface coating—Still another outgrowth of Duralon is a special type of the resin which has been found to have a breakdown voltage in excess of 5000 volts on a 0.005-in. film. When tested under direct arc, it shows no tendency to track even at high humidities. This formulation has a jet black glossy surface in high scratch resistance, low coefficient of friction and high resistance to wetting action by aqueous solutions. It will not char nor decompose at temperatures up to 425° F. It is used to coat surfaces and to laminate wood, cloth and paper.

Road-bearing surfaces and oil well plugs

Testimony to the variety of applications for furfural resins is provided by the experimental road near Moscow, Idaho, which shows that the use of the resin to wet aggregate before it is mixed with bituminous surfacing reduces the tendency of the aggregate to strip.[2]

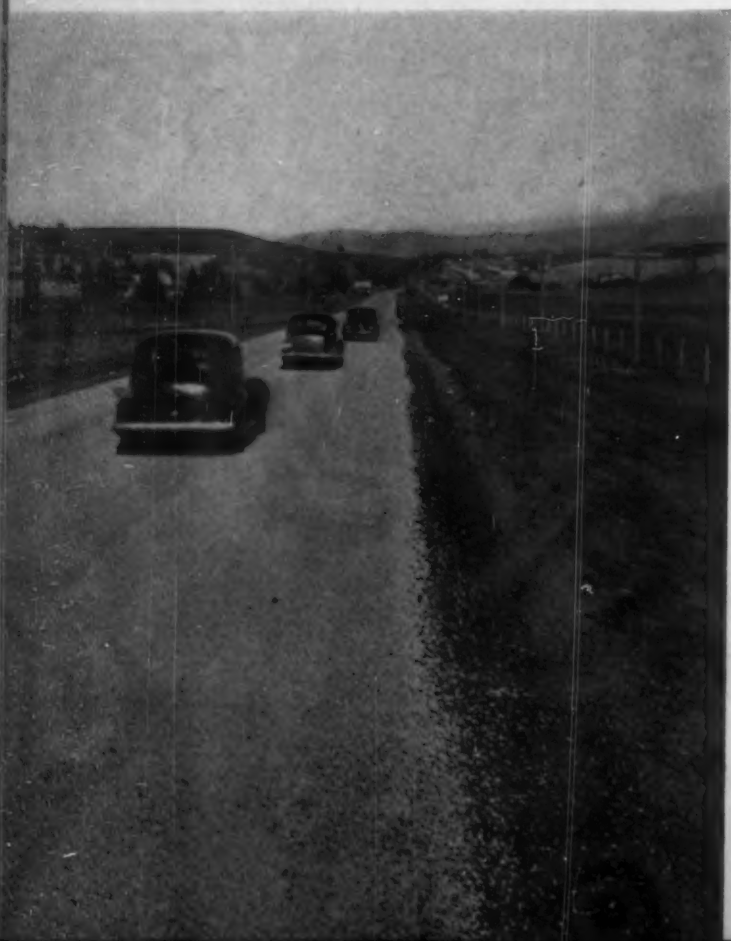
Preliminary tests were conducted by the College of Engineering and the Bureau of Highways of the State of Idaho following studies published by Dr. H. F. Winterkorn of the University of Missouri and the Missouri state Highway Department. Dr. Winterkorn found that after one week in water aggregate precoated with furfural resin showed a stripping resistance rating of 70, as compared with 60.5 for aniline-furfural and 19 for aggregate that had received no treatment at all. After 1 week in air, furfural resin rated 74, or slightly lower than 76 for aniline-furfural, and 46 for no treatment.

He also found that the property of furfural resins of improving the affinity of aggregate for bitumen also makes it suitable for roofs, airplane runways and other load-bearing surfaces. The resin may be combined with soil as well as aggregate. Two factors are needed—an aldehyde and a material capable of reacting with it to form a water-resistant resinous product. The first is satisfied by furfural; the second is filled by amines, phenols, ketones, sulfonamides, naphthols, urea or lignin.

Unique in the annals of plastics applications is the part played by furfural in a plugging compound to keep water out of oil and gas wells. Developed by Phillips Petroleum Company,[3] it is a non-acid liquid which, after it is in place, undergoes condensation, association and/or polymerization to form a resin that prevents the flow of liquids into the well bore. The resin is formed from urethane, and furfural in the presence of a catalyst. It remains liquid long enough to permit its injection into the formation and then becomes an insoluble plug within the pores of the formation. Setting time is controlled by varying the amount of catalyst used. It can be applied to the well bore directly through the casing or tubing, by means of a boiler or any conventional method suitable for lowering the liquid into the well.

[2] Patent No. 2,314,181, H. F. Winterkorn to Quaker Oats Co.

A highway near Moscow, Idaho, on which the furfural-dipped aggregate was used in bituminous road surfacing



Impregnating carbon and graphite

The use of furfural resins to impregnate carbon and graphite to render them impervious under pressure to seepage of liquids and gases is an application which has received insufficient attention and has appeal for the plastics industry as part of the chemical field.

Perfected by National Carbon Company, Inc., the method involves the polymerization of the resin in the pores of the carbon or graphite base material. The impregnated materials, sold under the trade-mark of Karbate, not only have more strength but they also retain the same high thermal conductivity of the base materials. The latter property makes this material ideally suited for fabrication into heat exchangers of all types for use with extremely corrosive liquids or gases.

Furfural was the first resin employed for this work and is still used in greatest quantity due to its resistance to corrosion by a wide variety of chemicals and its ease of handling. It has proved quite satisfactory at elevated temperatures. Exposure of one face of Karbate material to higher temperatures is permissible if sufficient heat dissipation is provided to maintain the body of the materials below the critical temperature.

Equipment is usually fabricated from carbon or graphite base stock by machining and cementing the parts. One of the cements used for this purpose is a furfuryl alcohol base cement that will set up at room temperature, although curing time is shortened by heat.

Chemical applications of Karbate, in addition to large tanks and heat exchanger tubes, include Globe- and Saunders-type valves, piston rings and compressor stuffing box packing rings.

[3] Patent No. 2,321,761, Phillips Petroleum Co., Bartlesville, Okla.

A furfural resin impregnated carbon or graphite base material is used for all parts of this centrifugal pump that contact the liquid. The corrosive liquid would attack metal

Chemical laboratory furniture

The chemical resistance of furfural resins is also the basis for still a further use in the chemical manufacturing field. The Institute of Paper Chemistry, Appleton, Wis.,[4] has perfected a process whereby a resin coating can be applied to various surfaces to produce an extremely resistant surfacing adapted to laboratory table tops, hoods, sinks, shelves, and other items. The material consists of a solution of alcoholic and aldehydic derivatives of furane, mixed with a solution of copolymer of vinyl halide and vinyl ester in acetone, with a resinification promoter.

Similar work was done by Kewaunee Mfg. Co., [5,6] which developed three variations—Kemweld top, Keminize finish used over the Kemweld top, and Kemrock, a sandstone-impregnated composition. The top comprises four layers of tempered Presdwood laminated under high temperature and pressure with a furfural resin similar to that developed by the Institute. The result is a 1 $^1/_4$-in. section of marked rigidity and strength. The high density of tempered pressed wood fiber makes the top virtually fracture- and dent-proof. It is also remarkably heat resistant and does not warp.

The finish, when applied to this top, impregnates the surface fibers and bonds the finish to the base. The final heat-treatment produces a finish that is insoluble even in the solvents used to apply the finish. It is capable of withstanding constant immersion for two weeks in 96 percent sulfuric acid, 37 percent hydrochloric acid, aqua regia, a mixture of potassium dichromate and concentrated sulfuric acid, and any concentration of caustic soda and potash, and the most penetrating solvents. Its lowest resistance is to nitric acid (sp. gr. 1.42), by which it is affected after 24 hours. The product withstands a reflected heat test of 150° C. for 24 hr. or more. Lighted cigarettes or matches won't destroy the finish.

The company has also developed a stable furane which does not require further compounding or mixing prior to use, and can be stored without danger of premature resinification. This is accomplished by incorporating a special catalyst and enough water to saturate the furane. It may be used for spraying, as a resin or binder with wood, flour or cotton flock, with thermoplastics and to extend phenol formaldehyde. Used with exploded redwood, it has improved molding characteristics and great physical toughness.

Kemrock, the sandstone impregnated composition, is suitable not only for table tops but also for sinks, hoods and reagent racks. Throughout the war, the company furnished a great deal of laboratory equipment to the steel, synthetic rubber and pharmaceutical industries (particularly for penicillin manufacture) and to hospitals. It is also adoptable for school laboratories.

A resin derived from furfural alcohol

Under the trade name of Furetone, Irvington Varnish and Insulator Co. has produced thermosetting resins derived from furfural which can be prepared in almost any viscosity from 50 to 30,000 centipoises. These resins may be used for casting and also for preparing cold-setting plywood bonding compounds. In their cured state, these resins are marked by extremely low water absorption and extreme chemical inertness, including resistance to strong alkalis and acids. They may be mixed with asbestos to form brake linings and other items of great flexibility, high impact strength.

A variation of these resins, obtained by reacting materials containing methylene groups with the condensation product of furfuraldehyde and ketones to produce substances which are neither brittle nor thermoplastic. Products made with these materials are suitable for use as binders and fillers in brake linings and clutch facings where it is necessary to have high resistance to rapid changes in temperature over a wide heat range and long periods of time.

These resins may be produced in viscosities suitable for binding abrasive particles such as emery and carbon to make grinding wheels, and also for resinous castings, coating materials, chemically resistant paints and electrical insulation. They may also be mixed with rubber reclaim and synthetic rubber to increase their resistance to oils, chemicals and improve their life.

Other applications

Among the miscellaneous uses for furfural resins may be listed phonograph records, printing plates, refrigerator strips and utensils—these being based on a resin which combines shell liquid of cashew net with a phenol-furfural condensation product, plus a hardening agent.

A versatile molding material suitable for low or no-pressure molding[7] has been produced from the residue of cashew nut oil, or Japanese lac, added to furfuraldehyde with an acid catalyst. It is suitable for both flexible and non-flexible surfacing. Both molding and coating varieties have found application in electrical insulation, and other uses include friction elements such as brake linings and clutch facings.

[4] Patent No. 2,267,830, Institute of Paper Chemistry, Appleton, Wis.
[5] Patent No. 2,333,151, Kewaunee Mfg. Co., Adrian, Mich.
[6] Patent No. 2,367,312, Kewaunee Mfg. Co., Adrian, Mich.

[7] Patent No. 2,317,587, Harvel Research Corp.

Plastic

The improved film exposure guide, steel hardenability calculator and high-speed carbide milling calculator (center), all fabricated of vinyl sheeting, are direct outgrowths of World War II calculators

calculators in war and peace

Experience in the production of highly accurate and durable military calculators is paying off in improved civilian units

HOW many rolls of wallpaper are needed for a room of average height, measuring 15 ft. long and 12 ft. wide? In taking a front-lighted photograph in hazy sunlight, what shutter speeds and lens openings will yield best results with a given type of film? If an automobile radiator solution shows a freezing point of 15° F., how many quarts of a particular antifreeze must be added to protect the cooling system against sub-zero temperatures?

Such questions and problems, whose solution would ordinarily require considerable figuring (and involve a strong possibility of errors) are now answered quickly and accurately by ingenious calculating aids, many of which gain added utility and durability from the plastic materials employed in their construction. G. Felsenthal & Sons, ranks high among the various plastics firms which have devoted special attention to the development and production of such instruments. Techniques perfected by the company in the production of a variety of navigational instruments for the Army Air Forces, the Bureau of Aeronautics and the Bureau of Ships are currently being employed in making numerous kinds of industrial calculators. Typical of these postwar models are an exposure guide for Ansco color film, an intricate steel hardenability calculator made for Bethlehem Steel Co., and a high-speed carbide milling calculator produced for The Cincinnati Milling Machine Company. Each of these time-saving devices is fabricated of laminated Vinylite sheet material.

Although the industrial calculating aids now being developed by this company may never have to stand up under such severe service conditions as did the military navigation instruments, a review of the company's experience with the latter brings out the particular adaptability of certain plastic materials in their fabrication.

Military work points the way

In the years immediately preceding World War II, standard aircraft navigational instruments were manufactured of etched aluminum or a combination of aluminum and cellulose nitrate. The latter construction demonstrated certain disadvantages, and vinyl sheeting was recommended to the Bureau of Aeronautics and the Army Air Forces about 1937 as a plastic that could be laminated and had dimensional stability.

The extensive use of this plastic by the Felsenthal Company underscores several properties of the material which render it ideal for such applications. Outstanding are its dimensional stability, clarity, resistance to moisture, salt spray, oils and similar liquids, and the fact that it will not support fungus.

The E-6B aerial dead-reckoning instrument made by the company for the Army Air Forces is a particularly good example for the advantages of properly chosen plastic materials for this type of application. This instrument is employed in working out speed, time and distance problems and altitude and air speed corrections. It was also used by bombardiers.

In 1940, the standard dead-reckoning instrument used by the AAF was made of aluminum, was fitted with a vinyl resin slide and weighed 6 ounces. The shortage of aluminum during the war made it necessary to turn to other materials One model was developed in brass which tipped the scales at an even pound—representing 10 extra ounces of dead weight.

The Felsenthal organization recommended that this instrument be fabricated of Vinylite; use of the same material throughout eliminating differences in thermal expansion. All calibrations were silk screened on black vinyl sheeting and shielded by a lamination of 0.005-in. transparent vinyl film. The assembly weighs 4 oz.—one-quarter that of the brass unit.

Cost comparisons on the aerial dead-reckoning instrument also reveal some interesting figures. The earlier combination model in aluminum and vinyl cost $13.60, while the brass version ran to $5.90. The all-vinyl instrument costs the Government less than $2.00.

A substantially different problem was encountered in connection with the composite speed scale extension arm for universal drafting machines, used in computations relative to the firing of torpedoes. This device had been previously fabricated of 1/4-in. thick acrylic, 20 in. long, with the letters and figures engraved and filled. Under the pressure of war orders, the length of time necessary to engrave the scales made satisfactory procurement out of the question. This company proposed injection molding the scales of high-temperature Lucite and proved its ability to handle the assignment on a fast production schedule, despite the necessity of maintaining an accuracy of ±0.010 in. on the 18-in. calibrated section of the scale.

There were other military applications too—transparent battle maps, map templates, plotting boards—that are now being translated into improved civilian calculating devices, all of which depend for success on the proper selection and processing of plastic materials.

CONTACT r

Standard patterns, plaids and solid colored fabrics are impregnated with contact resins and laminated to wood to form effective table and counter tops

NEW applications of so-called contact, or low pressure, laminates are coming thick and fast these days. Among the most colorful to catch the public eye is a line of furniture for casual living in which the tops of the breakfast, coffee and end tables, and the bar tops comprise variously printed plastic-impregnated fabric laminated to a plywood base.

Produced by Laminating Specialties, Inc., the plastic surfacing is a direct outgrowth of the work this company did with contact resins during wartime. A base of plywood fortified with a sheet of aluminum to which is bonded the impregnated fabric top, comprises the principal components of the completed laminate. The aluminum, bonded to the wood by a flexible adhesive, insures a permanent surfacing, eliminating the possibilities of warping or of the grains of the wood becoming raised.

The first step in the production of these tops is the printing of the fabric—a process which requires special dyes that will not run, streak or fade, or be otherwise affected by the resins. Although the specific dyes developed to date by the Calco Chemical Div. have proved satisfactory, experiments continue with a full color range the final objective.

Once printed, the dry fabric is cut to a size that is slightly larger than the finished table top, coated with resin and laid up with the aluminum covered plywood base. The laminate is then ready for curing—a slow controlled cure of one hour at approximately 220° F. having been found to establish a substantial safety factor and insure uniform predictable results. Bakelite XRS-69 and Laminac 4116 are the resins used for this work, partly because they are water white and do not, therefore, influence the coloring of the fabric, and partly because they impart a high finish, with a minimum of shrinkage, to the finished laminate.

Butt joints around the outer edges of the table tops, that might catch the dust, are eliminated through the expedient of rolling the fabric down over the upper corners and tucking it into a deep groove routed around the edge of the plywood base. The fabric is then wedged securely in place by the nickel-plated T mold which forms part of the outer trim.

resins in decorative surfacing

Almost any type of fabric that will absorb a resin, with the exception of wool, can be used as the covering materials. Silks, linen and fiber glass have worked out exceedingly well; but cotton has proved itself the best, so far. In part this is a matter of cost; in part, the adaptability of cotton to the requirements of silk screen printing.

Tests carried out by Sears Roebuck & Co. on these table tops have shown that its surface is in no way affected after being subjected to 270° F. for one minute. After 10 min. at the same temperature the surface was slightly yellowed. A temperature of 500° F. for one minute produced a slight yellowing while the same temperature for 5 min. produced a decided yellow color.

In tests for soiling, laundry soap, ammonia, acetic and citric acids, alcohol, writing ink, hot and cold water, and mercurochrome produced no effects. And the surfaces also exhibited exceptionally high resistance to abrasion.

In production at the present time are two sets of furniture for the home. A patio set in the Western manner features table tops in which the border design is made up of well-known ranch brands with a central pattern depicting a cowboy astride a bucking bronco. The plastic top of the breakfast room set is printed with an ivy pattern. A line of bar, table and counter tops for restaurant use is also in the making, featuring standard patterns, plaids and solid colors.

The design possibilities, however, are endless—as shown by the round table tops pictured on these pages. And the use of this laminate need not be limited to table surfacing. Panels, doors and special wall treatments might well be made up in a similar manner. In fact, the company has already produced special panels for motion picture sets. All of the work done by the company is on a custom-made basis.

ALL PHOTOS, COURTESY LAMINATING SPECIALTIES, INC.

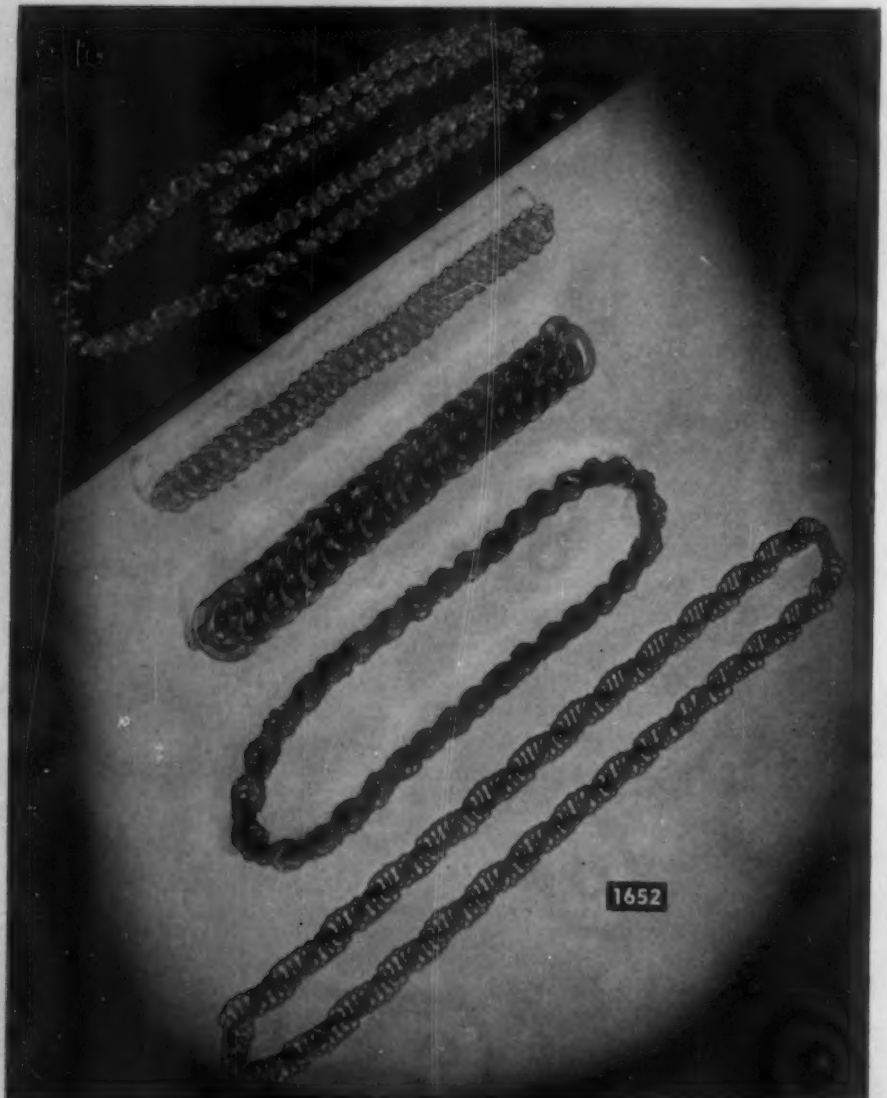
These flowered disks, close-ups of breakfast table tops, show the delicate patterns that can be achieved with resin impregnated fabrics. Tops are impervious to alcohols, acids and to scalding water

The base of the table top (right) is plywood, fortified with a sheet of aluminum. Fabric covering is laminated to this metal surface

Plastics Stock Molds*

SHEET ONE HUNDRED THIRTY-NINE

Molders and fabricators are invited to submit samples of stock products to appear on these pages as space permits.



JEWELRY FINDINGS

Nos. 1652–1653.

Plastic findings have become standard equipment for the jewelry and artificial flower trades. This unusual assortment of chains, ear clips, rings, brooch backs is colorful, easy to handle, and inexpensive. The chains may be worn as necklaces and bracelets, or can be used in combination with plastic or metal jewelry. Links may be purchased separately. Molded crosses are used for rosaries and other religious articles. Extruded, molded, and fabricated products are included in this group. Additional information, manufacturers' names and addresses, may be obtained from the Stock Mold Div., Modern Plastics, 122 E. 42nd St., New York 17, N. Y. Please state sheet and item number.

* Reg. U. S. Patent Office.

Items 1–1582, which have appeared previously, are correlated in the Plastics Stock Mold Catalog, available for $5.00.

Heat sealing thermoplastics†

by Wiley D. Wenger‡

LONG before the age of electronics, clear flexible seals of thin materials were obtained in various ways. Further, there is little reason to believe that the basic principles involved in the sealing of materials have been changed. The only real way in which electronics has affected sealing methods is by furnishing a source of energy that actually does not exist as heat until the energy is inside a material.

Basic sealing procedures

Heat affects the surface of a thermoplastic in a way similar to a solvent or a cement. It prepares the surface to be sealed so that if pressure is then applied, a bond results.

After you have prepared the surface to be sealed, you apply pressure uniformly, with or without heat. You do not force the faces nor distort them because a joint made under stress is not good. You do not substitute force for a fit, nor disturb the seal before it is set. You find that care and accuracy in the dies or fixtures you use are well worth while.

In case you are using solvents to obtain a suitable sealing area, you wait for them to take effect. When the surface cushion has been developed, pressure is applied. The result is an intermingling of the thin films and a bond that is strong and clear. There are disadvantages to solvent sealing methods, however. Among these are the need for extra operations and the continued effects of solvent penetration.

Many of the new plastic sheets and films can be sealed without the addition of solvents or plasticizer. Ordinary heat will cause the surface to which it is applied to become soft. If raised to the melting temperature, two such heated surfaces will, under pressure, intermingle and become one.

Conduction heat sealing

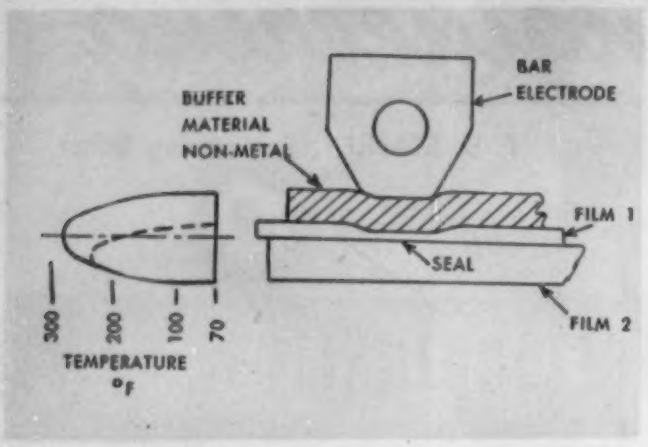
The edge or butt welding of acrylic sheet stock has been done successfully through the use of a "hot blade" type applicator. Immediately after heating two surfaces, the knife is removed and pressure applied to the two plastic pieces. If the blade temperature is too high, the plasticizer of the materials is vaporized or burned and no bond results. If the blade is too cool, no seal will be made. The time involved in such hot blade sealing must also include a cooling period.

Because the application of heat directly to the interface of a seam of thin films or sheet stock is difficult, critical of control and limited in application, this system is not practical for most sealing jobs. The general method of heat sealing plastics or plastic coated materials has involved the application of heat from the outside by means of hot dies, bars or rollers. This is satisfactory under certain conditions, but extrusion of

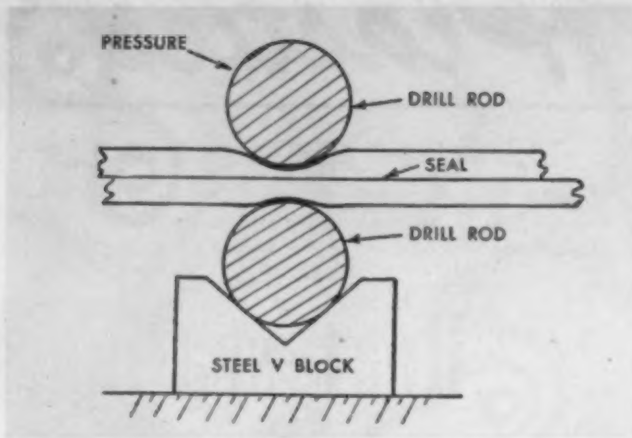
1—*Most thermoplastic materials can be heat sealed in an operation similar to that of a sewing machine by the use of high frequency power applied to metal rollers*

PHOTOS AND DRAWINGS 1 THROUGH 16, COURTESY RADIO CORP. OF AMERICA

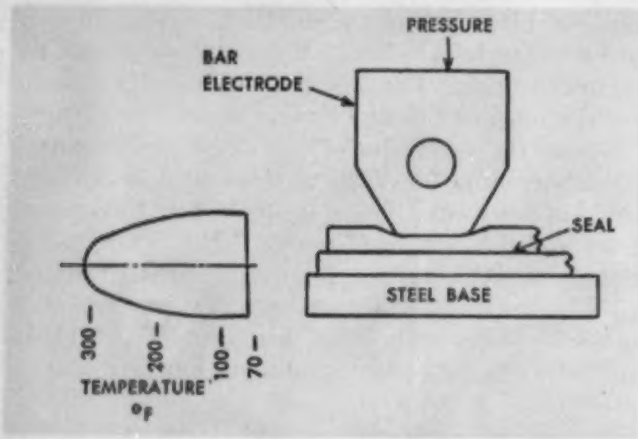
* Reg. U. S. Patent Office.
† All the material in this article, except that relating to the Singer Sewing Machine Co. and Union Special Machine Co. machines, was prepared by Wiley D. Wenger.
‡ R.C.A. Victor Div., Radio Corp. of America.



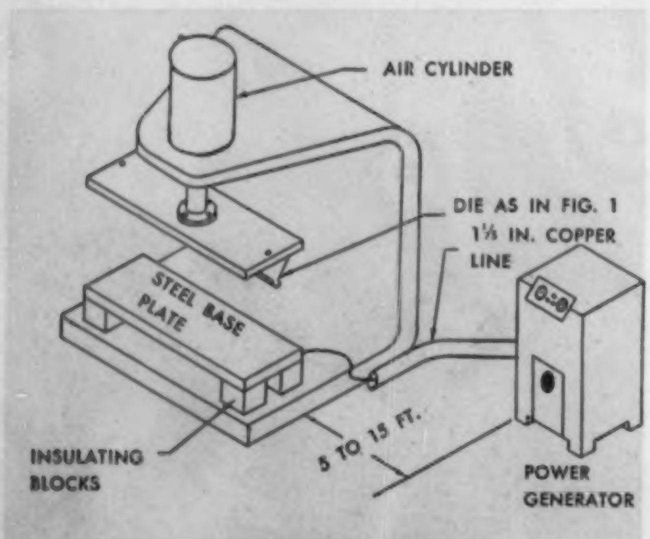
2—The best way of sealing a thin section to a thick one is by use of buffer material between electrode and film



3—In this simple sealing set-up, lengths of drill rod (preferably under 5-ft. long) are being used as electrodes



4—By using a movable bar as one electrode and a stationary steel base as the other, films of the same thickness can be sealed without the use of a buffer. The temperature gradient in the joint is indicated at left of drawing



5—This simple set-up of electrodes (one fixed, the other operated by air cylinder) may be achieved by using an arbor press. One electrode is insulated; other grounded to frame

the outer surfaces of plastic film results. Using this method, the heat sealing time depends upon the heat conduction time and the cooling period.

Dr. George H. Brown and associates, of the RCA Princeton Laboratories, constructed a heat sealing device which did not depend upon heat conduction but upon the application to the material to be sealed of electrical energy, of a high alternating frequency. This energy could quickly raise the temperature of the plastic to its melting point; the electrodes used to apply the energy were cold, however. The cold metal electrodes were employed to simultaneously raise the temperature of the plastic to the bonding point, apply pressure and cool the outside surfaces.

Continuous seaming

In the laboratory machine shown in Fig. 1, two metal rollers move the material that is being sealed while brush contacts apply radio frequency current to them. Pressure is secured from the rubber band. The heat from the outer surfaces of the plastic is carried away by the metal rollers. Both rollers are driven; variable speed is incorporated. The frequency of operation is 60 megacycles. One later model had an attachment for making a 2-in. seal in one shot as a bar sealer.

Demonstrations of this laboratory device were of considerable interest to fabricators and a need for a commercial design became evident. While the Radio Corp. of America did not enter into the "sewing machine" business, other companies have built devices similar to one in Fig. 1 but more suitable for manufacture on a large production basis.

One shot seals

Because the same principles apply to rollers and bar type sealers, the diagrams in Figs. 2, 3 and 4 will serve to clarify what has been said in preceding paragraphs. In these drawings, the electrodes are in the shape of bars, which may be any reasonable length. In practice, the length has been kept to about 5 ft. because that is a practical requirement for most products as far as

handling and other factors are concerned. The temperature curves shown at the left of the drawings indicate the way in which the heat is distributed through the material. Notice that it is possible to secure the highest temperature at the interface of the two sheets to be sealed when a buffer is used. The dotted lines indicate what would occur without the buffer.

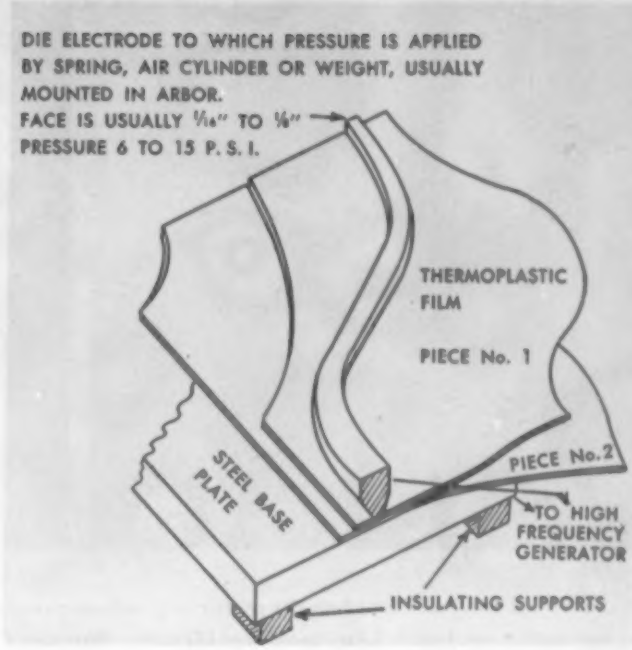
The electrodes may be mounted in an air press with the top die connected to the frame. The lower electrode may be either a flat steel plate, as shown in Fig. 5, or of a shape similar to that of the top bar. In any case, one electrode should be electrically insulated from the press. If the sealer is to be operated continuously, water cooling may be incorporated so that the heat absorbed from the product does not change the bar or plate temperature too much. A curved seam would be made by shaping the top die like the one in Fig. 6.

A typical small bar sealer for making a 4-in. seam is shown in Fig. 7 connected to a 100 to 150-watt generator that operates at 200 megacycles. This combination is suitable for sealing very thin materials. The 200-megacycle oscillator is capable of sealing from $^1/_2$ to 1 sq. in. of material at one shot, the smaller area being for thin materials of from $2^1/_2$ to 4 mils thickness. The rapidity of heat flow to the cold bars from very thin stock accounts for difference in area which can be sealed.

When sealing larger areas in one shot, a frequency of 20 to 30 megacycles has been found sufficiently high. Commercial units with power ranges from 500 watts to 100 kilowatts are available in this general frequency range. The use of these frequencies for sealing is not critical, having been chosen in the main because of voltage breakdown considerations. Very high frequencies make possible rapid heating of very thin materials and more speed from the roller type applicators, but are not necessary for large bar sealers.

A standard two-kilowatt unit capable of sealing up to 10 or more sq. in. of seam area at one time is shown in Fig. 8. A large experimental bar sealer for use with this generator is shown in Fig. 9.

The applicators are round rods. One is $1^1/_2$ in. in diameter and weighs 30 lb.; the other is a piece of drill rod resting in a V block mounted in the table top.

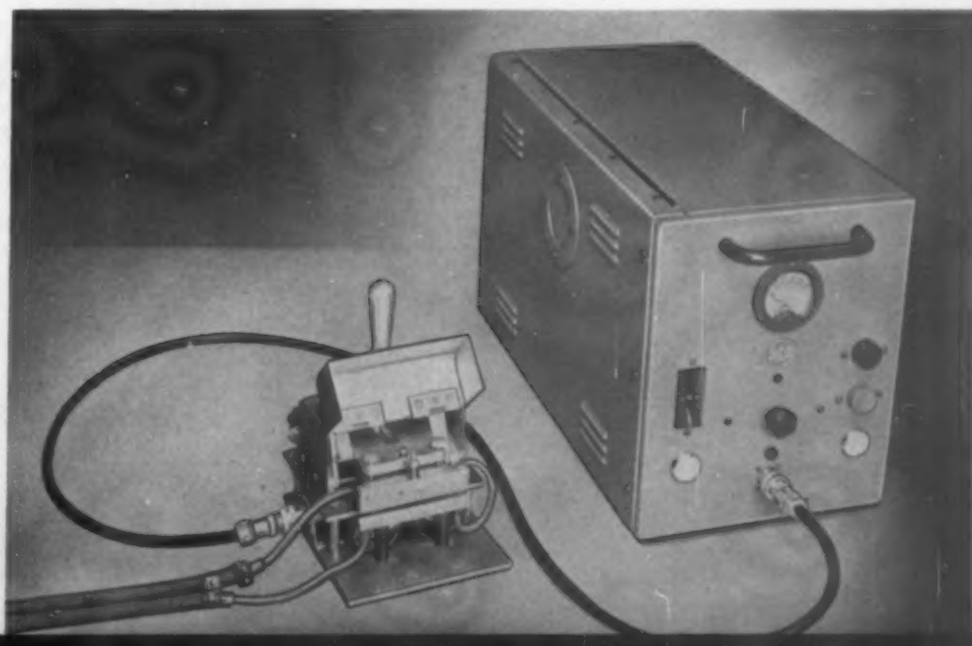


6—Curved seals are easy to make if this type of set-up is used. The upper movable electrode must be curved of the exact shape of the desired seal. Pressure of 6 to 15 p.s.i. may be applied by springs, air cylinder or weight. Power requirement: 2 kw. will produce a seal about 48 by $^1/_8$ in. on 0.004 material, or about 96 by $^1/_8$ on 0.008 material; 100 watts, on the other hand, will produce a seal about 4 by $^1/_8$ in. on 0.004 material or 8 by $^1/_8$ on 0.008 material

Gravity is the pressure source. Normally the bar is down so that stresses will not cause it to warp. Power is furnished by generator 15 ft. away.

Two seams made at once

It is possible to seal more than one seam in one shot, provided the seams are made simultaneously. A laboratory photo of a fixture for this type of operation design is shown in Fig. 10. Three pieces of a pattern are inserted in the fixture and the top element, which serves as a common electrode for both sides, is closed



7—A typical small-sized bar sealing unit complete with high frequency generator. In this unit, electrodes are water cooled

8

9

8—This 2 kw. oscillator has the power to produce a seal with an area of as much as 10 sq. inches. 9—An experimental bar sealer used with 2 kw. oscillator (Fig. 8). Bars are 4 ft. long and seal this length of 4 mil material in one second

down. A flat plate holds the side pieces in contact with the outer electrodes, which are brought into place as the flat springs lift the center piece so that a turned up edge seal is made. With the fixture shown in Fig. 10, a continuous seam is achieved in 1 second, producing a completely sealed bathing cap.

Applications and materials

In this quick review of the subject of sealing thermoplastic materials by means of high-frequency energy, many specific examples have, of course, been omitted. Belts and button holes are examples as are ping-pong and beach balls, surf boards and wading pools, solar stills and water bags, baby pants, bibs and dress shields. In discussing the means used to seal these multitudes of products, the subject of materials is very important, yet little specific information can be presented at this time.

The materials themselves are new and production problems face their manufacturer. Some variation in

10—Experimental unit for heat sealing three pieces of a pattern at one time. A bathing cap was made in this sealer

characteristics should, therefore, be expected. All thermoplastics do not heat-seal by the electronic heating method. Polystyrene, for example, because of its electrical properties, will not get hot enough to seal.

However, laboratory data as to the sealing properties of most thermoplastic films indicate that most any of them heat seal readily. Since such data may not be complete or up to date, the best procedure is to consult your plastic supplier.

I believe I have made it clear that electronic heat is still heat, so I hope you do not expect to fuse by electronics materials that you would not expect to seal otherwise if you could get heat to interfaces. Material coated with heat sealing plastics will seal, but the bond will usually separate at the point where the coating has been applied to one surface of the material.

Seal strength

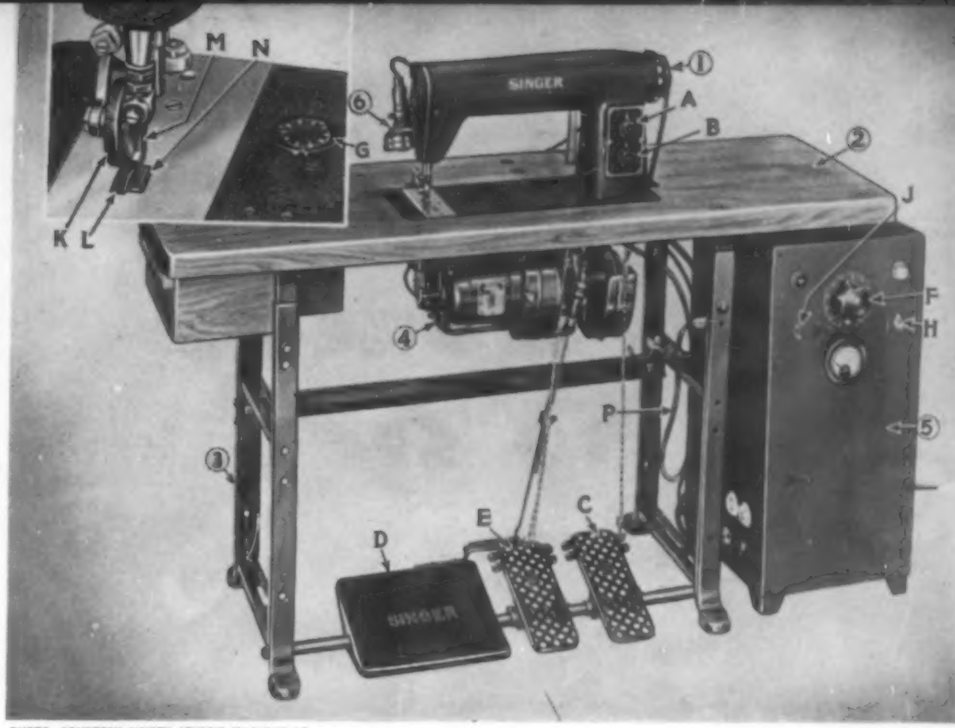
As was pointed out in the beginning, electronic sealing is heat sealing. But, because the heat is confined and controlled, more uniform seals can be made. Further, the strength of the seal is not weakened by extrusion of the hot material around the bars. No solvents are added to the material to be absorbed by it, and no glues are present to deteriorate.

Scanning versus die sealing

In studying the advantages to be gained by the use of electronic sealing, you should consider each of the two distinct methods of using such power. If you can adapt a fixture or die, and arrange to hold the pieces properly so as to obtain "kick press" production of your product, you will benefit from long run production of this type. The power of the electronic generator must be large enough to heat the total area desired in one press operation. Thick materials can be sealed.

Where intricate patterns or shapes are required, or where quantities are small and changed often, the

11—*This bonding machine produces an overlapping continuous sealed joint. A roller press K holds the thermoplastic sheets firmly down against lower electrode end while seal is being made. Intermittently, and at high speed, this roller releases the work. The feed wheel L carries work forward and sealing cycle is repeated. Amount of overlap which is obtained is adjustable*



PHOTO, COURTESY SINGER SEWING MACHINE CO.

scanning technique of a sewing machine should be used. No further costs are involved and almost any seam can be made. If speed is not important, a seal of any length can be made on a sewing machine. The same power is used regardless of the work being done.

Since the original RCA laboratory "sewing machine" was built in our laboratory, other companies have displayed devices using the same principles but incorporating additional features. They look like needle and thread machines, but do a different job in a new way.

Two electronic heat sealing machines

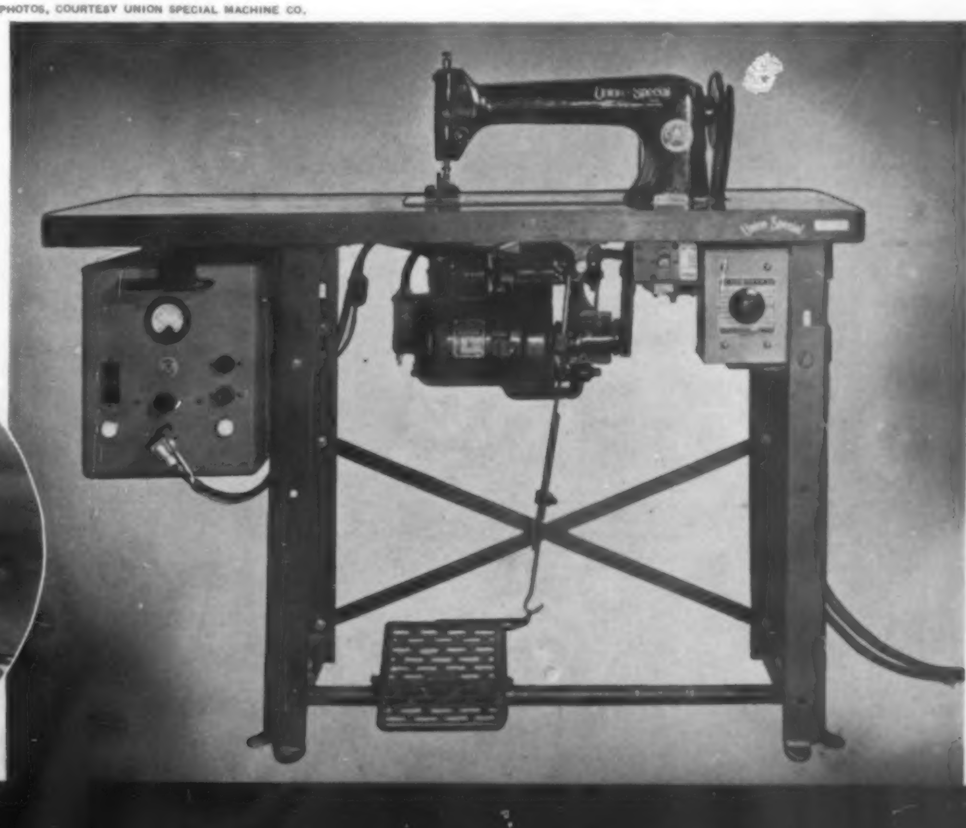
The Singer electric bonding machine, put out by the Singer Sewing Machine Co., seals by means of a small bar sealer that goes up and down rapidly (Fig. 11), each pressure stroke overlapping the previous one. While the bar electrode is up, an intermittent drive wheel pulls the material forward. The movement of this wheel, between strokes, is adjustable. This controls the overlap and thus the speed of seal in feet per minute. The resultant seal is a continuous bond. Speed is controlled by two adjustment knobs. Frequency of current applied to bars is about 60 megacycles.

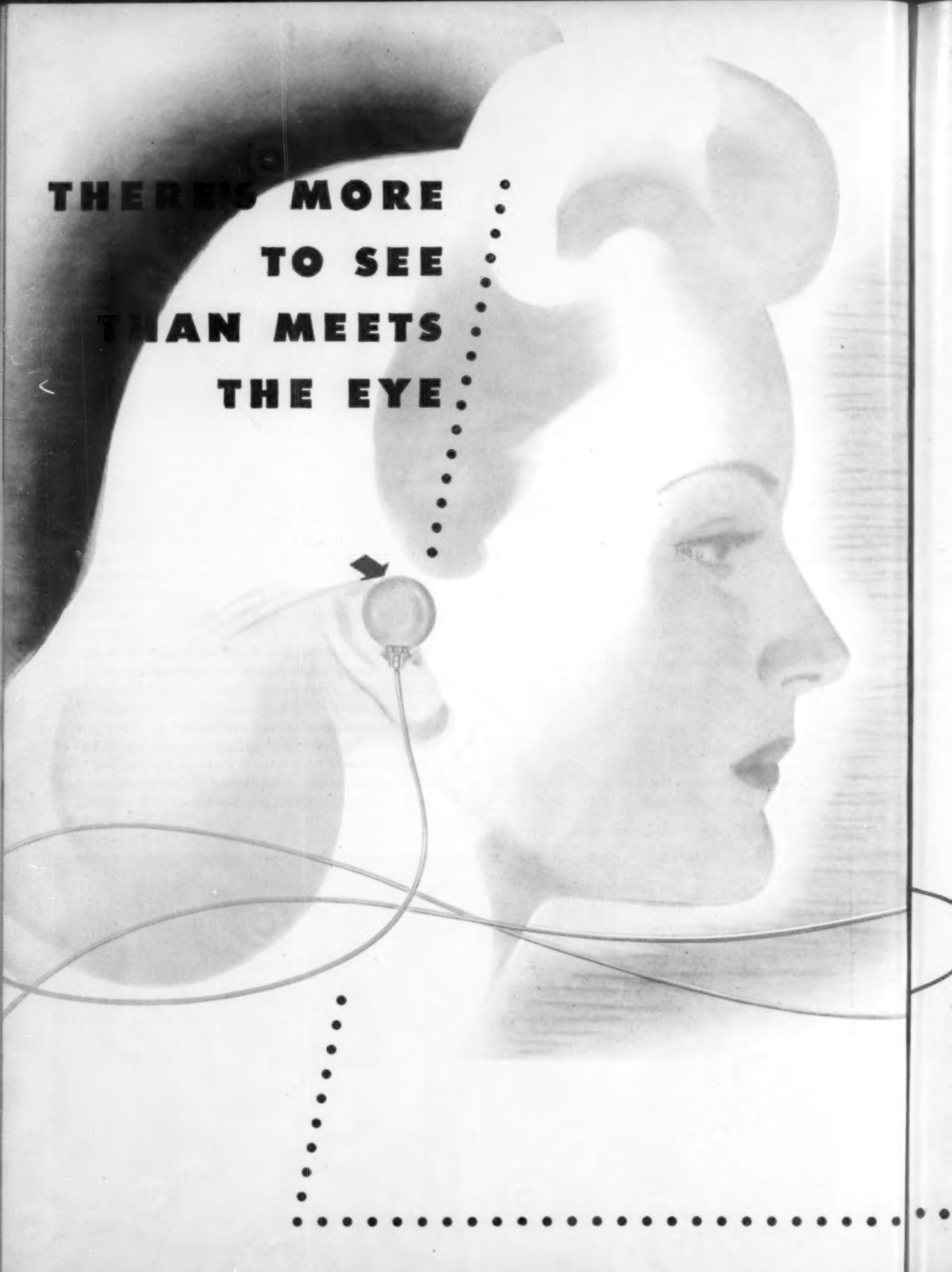
A second machine manufactured by Union Special Machine Co. is a roller type unit. Figure 12 shows a close-up of the wheel arrangement. The copper strap shown in the laboratory photo is replaced by a folder or other attachment plate on the machine. The unit has been designed so that if the material varies in thickness from two 4-mil sheets to ten 4-mil sheets, the temperature of the seam will remain constant and the seam will be uniform. The same rollers that feed the material are used for sealing and are continuous in movement.

These machines are not experimental. They are industrial machines which reflect the best knowledge of the process at this time. There is no pretense that they make obsolete a needle and thread device but they will do many jobs formerly limited to that process.

PHOTOS, COURTESY UNION SPECIAL MACHINE CO.

12—*This sealing machine is a roller type unit in which, as shown in close-up of sealer at left, the upper and lower rollers act not only as electrodes but as feeders of material. Frequency applied to rollers is 200 megacycles*




THERE'S MORE
TO SEE
THAN MEETS
THE EYE

1

ALL PHOTOS, COURTESY OWENS-CORNING FIBERGLAS CORP.

1—First step in producing resin impregnated glass fabric molds is laying up of impregnated glass cloth on wood building form the size of the finished part. 2—After layers of glass cloth and glass mat have been built up on form, lay-up is put inside of rubber bag and a vacuum drawn. Assembly is then cured in autoclave

Plastic molds for electronic vulcanizing

2

For the successful operation of electronic vulcanizing, which cuts cure time and improves the quality of rubber products, molds must be dielectric — a property possessed by resin-impregnated glass fiber fabric molds

A DEVELOPMENT that promises to cut processing time 90 percent or more is of major interest in any industry. Such a development is the electronic vulcanization of both synthetic and natural rubber, considered potentially one of the most important contributions of research to the progress of the rubber industry and to the production of better and lower cost rubber products.

Electronic curing is already being employed successfully in the production, on a commercial scale, of sponge rubber products, such as mattresses and automobile seats and cushions, at a fraction of the former curing time. Electronic curing of tires and rubber mechanical goods is still in the development stage. But the commercial curing of large hard rubber wheels in minutes instead of hours and the curing of brake blocks in 15 min. as compared with 1 hr., gives an idea of the overall possibilities that are inherent in electronic vulcanization.

Dielectric molds required

As with any technological development, there are numerous problems that have to be worked out in the commercial application of electronics to the vulcanizing of natural and synthetic rubbers. One of these concerns the molds employed to form the products into the required shapes and contours.

Vulcanization is the joining of sulfur and rubber molecules through the application of heat. Conventional vulcanizing methods make use of steam heat

and metal molds. But, because metal is not a dielectric, metal molds cannot be used in the electronic process. It is in the solution of the problem of what kind of mold to use that plastics play a part.

When electronic curing is employed, a non-metallic mold containing the rubber object to be cured is placed between two metal plates of a capacitor (condenser) connected to the output terminals of an electronic generator. The mold and the rubber object, which itself is dielectric, thereby become the dielectric of the capacitor. Since neither the mold nor the rubber is a perfect dielectric, they admit, by dielectric absorption, some of the current in the electronic field that surrounds both of them.

The high-frequency alternating current supplied by the generator flows into and out of the mold and rubber object 1 to 100 million times a second. The terrific speed with which the current changes direction causes the sulfur and rubber molecules to vibrate back and forth with inconceivable rapidity. In this wild melee, the molecules rub against each other and this molecular activity and the accompanying frictional heat—about 212° F., in the case of sponge rubber products—link the molecules together in the form of vulcanized rubber.

Many mold materials tested

Wood, plywood and other dielectric materials have been tried out as molds, but low-pressure plastic laminates, with alternate layers of Fiberglas fabric and mat as the base, have been found to work out most satisfactorily. In addition to being dielectric, the resin impregnated glass fiber fabric molds possess other essential properties including high tensile and impact strength, light weight, dimensional stability and high temperature resistance. Further, the plastic laminate has a dielectric constant matching that of rubber, so that the molds are heated to the same temperature as the rubber content. The molds are easily formed to complex contours and have demonstrated their ability to withstand rough handling. (*Please turn to next page*)


3

3—A curing cycle of approximately 40 min. is usually sufficient for these molds. After they have been removed from the form they are given an immediate coating of thermosetting resin varnish

4


4—The rough edges of the low-pressure molded resin impregnated glass cloth molds are carefully trimmed with a band saw

The glass fabric plastic molds currently used are fabricated by the Baker-McMillen Company.[1] Alternate plies of glass fiber cloth and mat are cut to size, impregnated with a low-pressure thermosetting resin, and laid up (Fig. 1) on a wood building form which is an exact replica of the object to be cured and which has been covered with a parting medium such as Cellophane or polyvinyl alcohol. The number of plies of mat and cloth varies in different molds, depending on the rigidity and bulk required. The rigidity and bulk depend, in turn, on the size and shape of the rubber object to be cured.

A rubber bag is laid over the assembly and a vacuum is drawn. The assembly is placed in the autoclave (Fig. 2) and cured under combined steam and air pressure of 63 p.s.i. and at a temperature of approximately 280° F. The curing cycle is approximately 40 minutes. After the cured mold is removed from the building form it is carefully finished with a coat of thermosetting varnish.

[1] Company filed broad patent claims to protect its mold fabrication process.

Uniform curing assured

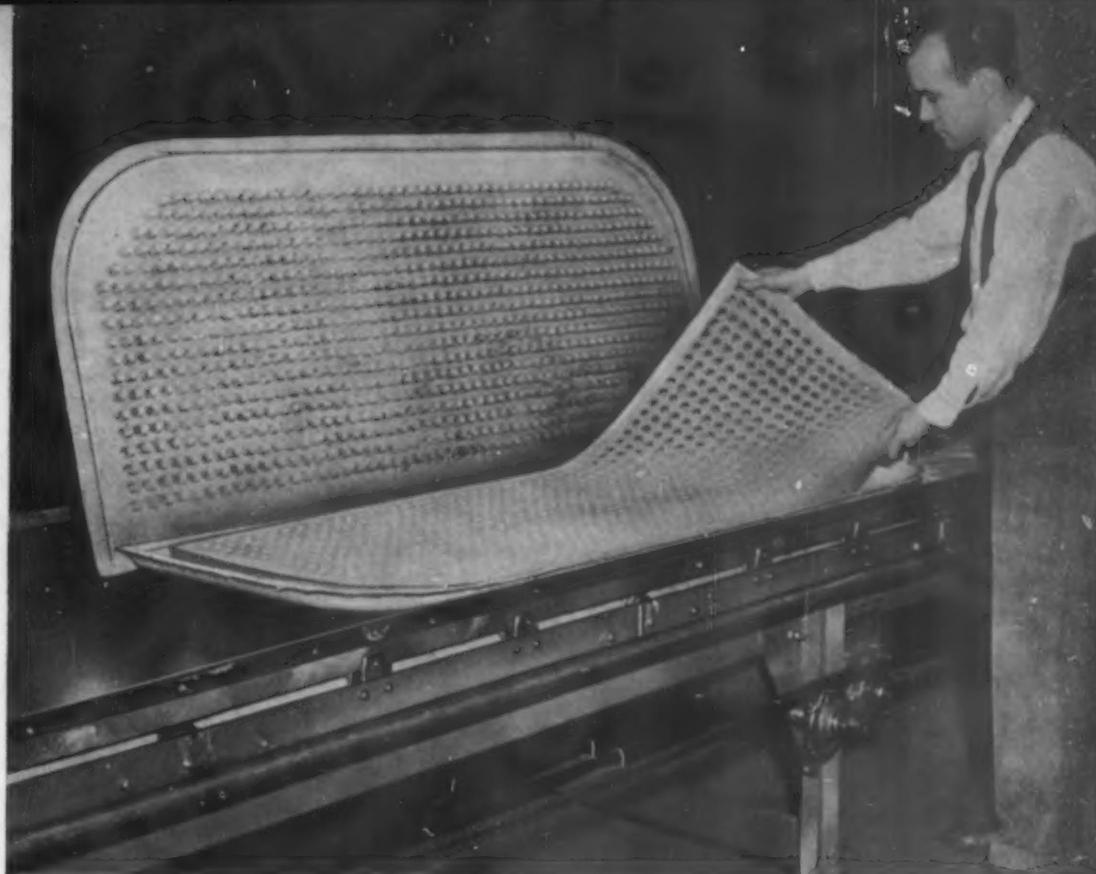
Aside from savings in curing time, a great advantage of the electronic process is that instead of heating the rubber object slowly and unevenly from the outside in, as in the steam process, the electronic process heats the entire object evenly and in a matter of seconds or minutes. There is no danger of over-curing on the outside and under-curing in the center.

To assure such uniform heating, it is important that the mold heat in step with the rubber—that each have approximately the same loss factor. If the mold heated more quickly or more slowly than the rubber, it would tend either to over-heat or cool the outside of the object being cured. The resin impregnated glass fiber fabric molds heat at approximately the same rate as their rubber content.

5—With pins in place in the plastic mold and the cover trimmed, mold is ready for production

6—To form the deep circular depressions that extend part way through rubber cushions such as are used in the rear seats of automobiles, holes are drilled in the mold cover into which are then inserted pins which have over-sized heads

7—The low pressure plastic mold and rubber cushion for rear seat of a Lincoln automobile just after they have been removed from the electronic vulcanizer. 8—Recently a sponge rubber mattress for a full size bed was produced by electronic vulcanizing, which again used a resin-impregnated glass fiber fabric mold



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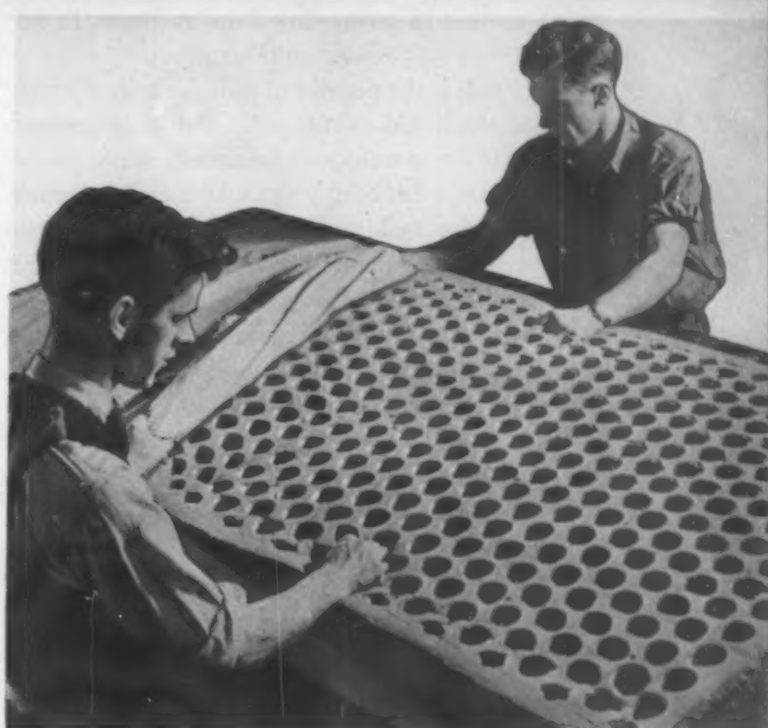

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The light weight of the Fiberglas-plastic molds, as compared with the weight of metal molds, greatly simplifies handling problems. The heavy hoists required to handle large metal molds are no longer required. Molds and their content of uncured rubber can be delivered to the vulcanization chamber by a conveyor line while another conveyor line carries them from the chamber after the curing cycle.

Pioneering a new process

The pioneers in this electronic curing of rubber products are the B. F. Goodrich Co. and Firestone Tire and Rubber Co. As holders of the basic patents, they have formed Industry Inventions, Inc., with V. L. Smithers, of V. L. Smithers Laboratories, as general manager, to continue research and to handle the licensing of other companies. Both of the above mentioned companies are also continuing their own research in their technical laboratories.

Last fall one of the first commercial type electronic vulcanizers, using 125 kilowatts of electronic energy to service two complete vulcanized chambers, was installed[2] for the manufacture of sponge rubber products. It was designed by engineers employed at the Firestone Tire and Rubber Co. and at Westinghouse Electric Corporation.

Very recently a resin impregnated glass cloth mold for a full-sized bed sponge rubber mattress was tested—the largest mold ever made for sponge rubber. Cure time was one-tenth of that required with the steam process and the quality of the mattress was much improved. Sponge rubber automobile seats and cushions have also gone into production using resin impregnated glass fiber fabric molds and the new electronic method of vulcanizing.

In fact, electronic vulcanization of rubber mechanical goods and tires has made much greater progress than is generally realized. The application of electronic vulcanization to all types of rubber products, is rapidly gaining momentum. Large, hard rubber wheels are now being treated electronically for 2 min. and then are placed under steam heat for 18 min. to finish the cure. The preliminary electronic treatment cuts the total curing time from 300 to 18 minutes.

[2] Installed at the Fall River plant of the Firestone Tire and Rubber Co.

Data on low-pressure laminating resins*

THIS is the second set of charts on low-pressure laminating resins, commonly used with a Fiberglas base, which MODERN PLASTICS magazine is publishing. The preceding set of charts appeared in the June issue between pages 144, 145.

For a full discussion, intended to clarify and amplify the data presented, readers are referred to the June issue, but for those to whom the June issue may not be immediately accessible the most salient features of this discussion are repeated here.

It will be noted that the resins fall into different groups which are basically different in both properties and handling methods. For this reason, it is necessary to use discretion in comparing data on resins in one group with data on resins in another group.

Percent solids is the percent of resin, or resin-forming material, in the liquid as shipped. Pot life represents the length of time a resin may be stored, under proper conditions, after it has been prepared for use in treating.

The figure for resin content represents the resin content to which the manufacturer believes the glass fiber fabric base should be treated in order to produce a good structural laminate. For many applications, a different resin content might be used to obtain certain desired properties in the laminate.

In all cases the values given are intended only for broad comparative purposes and as a guide to the laminator in determining by experiment what particular resin content is required in his particular application.

Where solvent is used, volatile content is measured after the treated glass fiber cloth has been dried. It is a measure of the amount of flow that can be expected in the curing operation. Where given, the volatile content is the percentage weight lost from a 3-in. diameter sample heated for 10 min. at 300° F.

Almost all of the resins covered by the data can be handled with any of the different types of equipment employed by the laminator. Where this is not true, the type of equipment required is specified.

The time given for the curing cycle is usually the time required after a thermocouple placed in the center of the laminate reaches the specified temperature. The heat distortion point is determined by the standard A.S.T.M. test under high load. Data on electrical properties are for resin castings based upon standard tests.

Information on end uses represents for the most part potential applications expected to develop from the use of low-pressure Fiberglas-resin laminates in war applications.

Some of the resins are in pilot plant production and the prices shown are derived from this experimental operation. Therefore, the prices may be changed as the resins are produced in commercial quantities. For this reason, price should not be considered a decisive factor in the selection of a resin. Resin manufacturers will quote current prices on request.

New resins are being developed monthly and this chart does not represent all the latest developments in new types of resins which may be available in pilot plant quantities. Additional modifications of the resins are being made by the manufacturing of two resins, one having a high viscosity and the other a low viscosity. The purpose of making the two viscosities is to enable the laminator to mix these resins to give any desired viscosity for production laminating.

In preparing any listing of this type there is always the hampering circumstance that charts are accepted as the final developments in the field. This is so because the newer developments may not be readily available to a person selecting a resin—especially in the field of contact pressure or low-pressure laminating.

New developments are coming from the laboratories of resin manufacturers daily and many resins are being developed to meet specification needs. It is suggested, therefore, that the charts be used only as an indication of the *type* of resins that may be suitable for some particular end use.

The proper procedure would be to obtain specific information from the resin manufacturer to determine the resin most suitable for the application involved. If the quantity required warrants the expenditure of laboratory time, resin manufacturers will normally develop resins for specific requirements.

* Prepared by York Research Corp., Plastics Div., for Owens-Corning Fiberglas Corp.

DESCRIPTIVE

PREPARED BY YO

Manufacturer	Resin: Company number	Resin: Identity	Price: Price/lb./carload f.o.b.	Physical characteristics of uncured resin: Solids	Viscosity centipoises	pH	Solvents	Storage: Conditions	Storage: Life	Modifications	Treater operatio: Resin content	Catalysts	Inhibitors	Impregnation: Apparatus	Impregnation: Preparation of resin	
			$	%							%					
MONSANTO CHEMICAL CO., PLASTICS DIV.	Styramic HT	Polydi-chloro-styrene Dichloro-styrene	8.72 8.67		Varied by varying ratio of monomer to ploymer.		Soluble in aromatic and chlorinated hydro-carbons.							Dip-tank Squeeze roll Roller coating Brush Knife coating	Dissolve 25 parts of polymer in 75 parts of monomer. Add peroxide catalyst.	
	Thalid X-500 series XR-530	Un-saturated polyester	0.56	100	1800 to 2800	Slightly acid	Ethylacetate, dioxane, benzene, toluene, ethylene dichloride, low mol. wt. chlorinated hydrocarbon.	No catalyst: 25° C..... With catalyst..	.. 2 mo. .. 5 days	X-528-S: 100 parts XR 530, 5 parts styrene, 0.5% benzoyl peroxide. X-528-S: 100 parts XR 530 12 parts styrene 0.5% benzoyl peroxide	40 to 60	5% benzoyl peroxide ultraviolet light	Nickel, manganese, lead, cobalt, chromium, are to be avoided in cure.	Dip tank Squeeze roll Roller coating Brush Knife coating	Catalyst is dissolved in styrene and mixture is then combined with XR-530. Agitate, exclude air.	May sty by ora
PITTSBURGH PLATE GLASS CO., COLUMBIA CHEMICAL DIV.	Allymer C.R. 39	Allyl resin	1.00	100	25° C.-15.5 70° C.-6.4	Neutral	Alcohol, acetone, ethyl acetate, acetic acid, ether.	No catalyst. With catalyst....	.. Several months .. Approx. 2 wk.	Vinyl acetate or methyl methacrylate increase thermo-elasticity. Polyvinylacetate or nitrocellulose slight softening. Rezyl 19—good extender.	41	5% by weight benzoyl peroxide. Other peroxide may be used.	Air, copper, sulfur, vulcanized rubber.	Dip tank Squeeze rolls Brush coating	Heat monomer to 50° C. Add catalyst, stir until completely dissolved, continue stirring while cooling to room temperature.	
	Allymer C.R. 149	Allyl resin	1.15	100	25° C.-normally solid 70° C.-30-50	Neutral	Alcohol, acetone, ethyl acetate, acetic acid, ether, benzene, amyl alcohol glycol, carbon tetra-chloride.	No catalyst: 25° C..... With catalyst: 25° C..... 45° C.....	.. Several months .. Over 2 wk. .. Approx. 24 hr.	Rezyl 19—good extender. Vinyl acetate or methyl methacrylate increase thermo-elasticity. Polyvinylacetate or nitrocellulose slight softening.	41	5% by weight benzoyl peroxide Other peroxide may be used.	Air, copper, sulfur, vulcanized rubber.	Dip tank Squeeze rolls Brush coating	Melt resin by warming to 50-60° C. Add catalyst with agitation and air bubbling. After 1¼-2¼ hr., filter through cheese cloth and cool to storage temperature as quickly as possible.	
	Allymer 170	Un-saturated polyester in combi-nation with allyl-ester.	0.65	100	25° C.-12100 50° C.-970	About 3	Acetone, ethyl acetate, benzene, acetic acid.	No catalyst: 25° C..... With catalyst: 25° C.....	.. Several weeks .. Several hours	Used unmodified. Allymer 171 is similar to Allymer 170: with a cobalt metal accelerator it gives a resin curing in air.	41 to 45	2% by weight benzoyl peroxide. 4% Luperco ATC Diacetyl peroxide Tert-butyl perbenzoate	Sulfur, vulcanized rubber. Not as sensitive to air as CR-39 and CR-149.	Spreading Roller coating Knife coating	Blend catalyst into resin by agitation at room temperature.	
PITTSBURGH PLATE GLASS CO., PAINT DIV.	Selectron 5003	Addition-type copolymer	0.50	100	25 to 70,000 at 25° C., adjustable	Slightly acid	Amyl acetate, acetone, benzene, ethylene dichloride.	Uncatalyzed: 40° F..... 77° F..... 150° F..... Catalyzed: 77° F..... Away from sun	. Indefinitely . 4-6 mo. . Up to 10 days . 14 hr.-3 days	Add plasticizing resin, Selectron 5017, to improve flexibility. A cobalt metal accelerator helps cure in air.	40	Ultraviolet light 0.8-1.0% by weight benzoyl peroxide.	Saturating resin with sulfur inhibits cure.	Spreading Knife coating Roller coating Dip tank Spray Brush	Stir in catalyst. With higher viscosity resins use a paste catalyst.	S vol whi comp rea
	Selectron 5015	Addition-type copolymer	0.60	100	Paste at 25° C.	Slightly acid	Methylethyl ketone, ethylene dichloride, amyl acetate, benzene. As solvents at 130° F.	Uncatalyzed: 40° F..... 77° F..... 150° F..... Away from sunlight Catalyzed: 77° F.....	. Indefinitely . 4-6 mo. . Up to 10 days . 14 hr.-3 days	Add plasticizing resin, Selectron 5017, to improve flexibility. A cobalt metal accelerator helps cure in air.	40	Ultraviolet light 0.8-1.0% by weight benzoyl peroxide.	Saturating resin with sulfur inhibits cure.	Spreading Knife coating Roller coating Dip tank Brush	Add catalyst to melted paste.	S vol whi comp rea
	Selectron 5016	Addition-type copolymer	0.55	100	25 to 70,000 at 25° C. adjustable	Slightly acid	Amyl acetate, acetone, benzene, ethylene dichloride.	Uncatalyzed: 40° F..... 77° F..... 150° F..... Catalyzed: 77° F..... Away from sun	. Indefinitely . 4-6 mo. . Up to 10 days . 14 hr.-3 days	Add plasticizing resin, Selectron 5017, to improve flexibility. A cobalt metal accelerator helps cure in air.	40	Ultraviolet light 0.8-1.0% by weight benzoyl peroxide.	Saturating resin with sulfur inhibits cure.	Spreading Knife coating Roller coating Dip tank Spray Brush	Stir in catalyst. With higher viscosity resin use a paste catalyst.	So vol whi comp rea
PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO.	Plaskon 911	Copolymer based on unsatu-rated polyester	0.66	100	Room temp., 170,000	Slightly acid	Acetone, ethyl acetate and higher esters, cellosolves.	Before mixing and catalyzing.. Catalyzed 70-80° F...	.. Stable indefinitely .. 24 hr.	All modifiers are included in resin as shipped.	40 to 47	4% of a paste containing 50% benzoyl peroxide dispersed in tricresyl phosphate.	Anti-oxidants, vulcanized rubber	Knife coating Roller or transfer coating in special cases	Dissolve 4 parts paste catalyst in 100 parts resin.	

CRIPTIVE DATA ON LOW PRESSURE LAMINATING R

PREPARED BY YORK RESEARCH CORP., PLASTICS DIVISION FOR OWENS-CORNING FIBERGLAS CORP

Treater operations									Curing operations								He
Impregnation				Drying			Storage			Equipment			Curing cycle				
Apparatus	Preparation of resin	Volatile content	Flow content	Apparatus	Optimum oven temp.	Time	Temp.	Life	Mold release agent	Presses	Molds	Ovens	Optimum pressure	Optimum temp.	Thickness	Time	Cast resin
		%	%		°F.		°F.						p.s.i.	°F.	In.		°F
Dip-tank Squeeze roll Roller coating Brush Knife coating	Dissolve 25 parts of polymer in 75 parts of monomer. Add peroxide catalyst.									Standard equipment	Standard equipment Bag molding	Standard equipment	Contact				2
Dip tank Squeeze roll Roller coating Brush Knife coating	Catalyst is dissolved in styrene and mixture is then combined with XR-530. Agitate, exclude air.	May lose styrene by evaporation	No significance				Room dark	5 days	Cellophane, Silicone D 200, cellulose acetate flake dissolved in solvent either plasticized or unplasticized.	Platen any of conventional type	Bag, any conventional type	Any conventional type	Contact	Laminate temp. 320 at center		8 min. pull cold 30 min. pull hot	15
Dip tank Squeeze rolls Brush coating	Heat monomer to 50° C. Add catalyst, stir until completely dissolved, continue stirring while cooling to room temperature.						Room	Same as pot life	Cellophane, wax, PVA		Glass, iron, aluminum, zinc alloy, plaster, wood, cellophane, PVA	Heated air forced draft	1-5	Start at 158, Raise slowly to 238	1/8... 1/2...	...4-6 hr. ...6-8 hr.	10 m 140-
Dip tank Squeeze rolls Brush coating	Melt resin by warming to 50-60° C. Add catalyst with agitation and air bubbling. After 1½-2½ hr., filter through cheese cloth and cool to storage temperature as quickly as possible.						Room	Same as pot life	Cellophane, wax, PVA		Glass, iron, aluminum, zinc alloy, plaster, wood, cellophane, PVA	Heated air forced draft	1-5	194.. then 257.. 158.. then 194 then 239..	1/8 1/2	...1 hr. then ...½ hr. ...2 hr. then 2 hr. then ...2 hr.	10 m 149-
Spreading Roller coating Knife coating	Blend catalyst into resin by agitation at room temperature.						Room	2-3 days	Carbowaxes, cellophane, PVA		Glass, iron, aluminum, zinc alloy, plaster, wood, cellophane, PVA		1-5	212.. 248..	...1/8... ...1/4...	...5 min. .15 min.	23
Spreading Knife coating Roller coating Dip tank Spray Brush	Stir in catalyst. With higher viscosity resins use a paste catalyst.	Some volatile which is completely reactive		Store impregnated rolls.			Room	14 hr. to 3 days depending on pot life of resin	Carnauba wax, PVA (sheet or coating), cellophane, Vejin, carboxymethyl-cellulose	Standard equipment	Standard equipment	Standard equipment	Contact 10...	200 ...to... 250 ...275..	....	6-30 min. depending on pot life. Half of value above	17 *Se* *Note*
Spreading Knife coating Roller coating Dip tank Brush	Add catalyst to melted paste.	Some volatile which is completely reactive		Store impregnated rolls.			Room	Up to 6 mo.	Carnauba wax, PVA (sheet or coating), cellophane, Vejin, carboxymethyl-cellulose	Standard equipment	Standard equipment	Standard equipment	Contact	200 ...to... 250	....	6-30 min. depending on pot life	23 *Se* *Note*
Spreading Knife coating Roller coating Dip tank Spray Brush	Stir in catalyst. With higher viscosity resin use a paste catalyst.	Some volatile which is completely reactive		Store impregnated rolls.			Room	14 hr. to 3 days depending on pot life	Carnauba wax, PVA (sheet or coating), cellophane, Vejin, carboxymethyl-cellulose.	Standard equipment	Standard equipment	Standard equipment	Contact 10...	200 ...to... 250 ...275..	....	6-30 min. depending on pot life Half of value above	35 *Se* *Note*
Knife coating Roller or transfer coating in special	Dissolve 4 parts paste catalyst in 100 parts resin.						Room 40° F.	...2-3 days ...2 wk.	PVA sheet Cellophane, 1% solution of Vejin A3 (centrifuged in benzene). Methyl or ethyl	All standard types	Any metallic or non-porous surface. Plaster or concrete coated with Methocel or	All standard types	Contact	140.. then 176.. then 230.. 212..	.... 1/2 ...1/8...	.16 hr. then ..2 hr. then ..1½hr. .90 min.	

ING RESINS

GLAS CORP.

(Cure c)ycle: Thickness	Time	Heat distortion point: Cast resin temp.	Heat distortion point: Laminate temp.	Electrical properties of cast resin: Freq. 60 cycles: Power factor	Freq. 60 cycles: Dielectric constant	Freq. 60 cycles: Loss factor	Freq. 10^3 cycles: Power factor	Freq. 10^3 cycles: Dielectric constant	Freq. 10^3 cycles: Loss factor	Freq. 10^6 cycles: Power factor	Freq. 10^6 cycles: Dielectric constant	Freq. 10^6 cycles: Loss factor	Dielectric strength: Short time	Dielectric strength: Step-by-step	Arc resistance	End application	General notes
In.		°F.	°F.														
		232					0.0002	2.62	0.0005	0.0003	2.62	0.0005					Contact development department of Monsanto for further information. Transparent yellow color.
	8 min. pull cold 20 min. pull hot	158	Well over 212				0.0132 ← See Note 1 → 0.0111 ← See Note 2 →	2.94 3.72	0.052 0.0415	0.0271 0.0253	2.28 3.07	0.0915 0.078			70 sec. average		Note 1: Electrical properties on X-526 resin unfilled. Test panels ⅛ inch thick. Cure cycle: 8 hr. at 70° C. and 3 hr. at 110° C. Note 2: Same as above with additional bake of 16 hr. at 110° C. Resin has yellow cast. XR-535 unmodified resin, high viscosity. Usually shipped as XR-530—XR-535 modified with monostyrene. (Specially inhibited monomer XR-502.)
⅛... ½...	4-6 hr. 6-8 hr.	10 mils. 140-167	>266	← See Note 1 → 0.006	4.40 Note 3	0.03 Note 4	0.008	4.20 Note 3	0.03 Note 4	0.041	3.55 Note 3	0.15 Note 4	← See Note 2 → 390 v/mil.		249 sec.	Aircraft parts	Note 1: Samples ⅛ in. thick. Note 2: Samples ⅛ in. thick. Note 3: Test at 25.6°C; Rockwell hardness 50%. Note 4: Diam. of test electrode, 3.00 inches. Shrinkage in curing, 14%. Slight yellow cast, Excellent solvent resistance.
⅛ ½	... 1 hr. then ... ½ hr. ... 2 hr. then 2 hr. then ... 2 hr.	10 mils. 140-167	>266	← See Note 1 → 0.013	4.00 Note 3	0.05 Note 4	0.006	3.75 Note 3	0.02 Note 4	0.018	3.45 Note 3	0.06 Note 4	← See Note 2 → 390 v/mil.		Starts to burn at 10 ma. continuous (180 sec.) hole formed by 240 sec.	Aircraft parts	Shrinkage in curing, 9%. Slight yellow cast. High strength resin.
¼... ¼...	5 min. 15 min.	230	>266													Aircraft parts	Shrinkage in curing, 10%. Slight yellow cast. Rapid cure resin.
	6-30 min. depending on pot life. Half of value above	176 See Note 1		← See Note 2 →			0.00498	3.21		0.00995	2.96		346 v/mil. on 0.14 in. thick sheet			Aircraft applications, electrical appliances, housings and parts, structural applications.	Slight amber cast. Pigment concentrates and dyes are available. Resin is liquid. Shrinkage is 7-8%. Note 1: Contact Pittsburgh Plate Glass Co. for specific information on exact laminates desired. Note 2: For full information on electrical properties, contact Pittsburgh Plate Glass Co.
	6-30 min. depending on pot life	230 See Note 1		← See Note 2 →												Aircraft applications, electrical appliances, housings and parts, structural applications.	Shrinkage during cure, 7%. Pigment concentrates and dyes are available. Resin is a paste (not soluble at room temperature). Note 1: Contact Pittsburgh Plate Glass Co. for specific information on exact laminates desired. Note 2: For full information on electrical properties contact Pittsburgh Plate Glass Co.
	6-30 min. depending on pot life Half of value above	356 See Note 1		← See Note 2 →												Aircraft applications, electrical appliances, housings and parts, structural applications requiring highest order of heat resistance.	Slight amber cast. Pigment concentrates and dyes are available. Resin is liquid. Shrinkage is 7-8%. Note 1: Contact Pittsburgh Plate Glass Co. for specific information on exact laminates desired. Note 2: For full information on electrical properties, contact Pittsburgh Plate Glass Co.
½... ¼...	16 hr. then ... 2 hr. then ... ½ hr. 90 min.									0.026	3.4	0.085				Ducts, radar housing, aircraft parts, cabinets and panels, furniture.	Resin has a light amber color, doesn't darken with age. Resin comes in 3 parts, two liquid resins and catalyst paste.

special							40° F.	.. 2 wk.	Methyl or ethyl		Methocel or			212 ..	... 24 ...	. 90 min.

PLASKON DIV., LIBBEY-OWENS-FORD GLASS CO.	Plaskon 911	Copolymer based on unsaturated polyester	0.66	100	Room temp., 170,000	Slightly acid	Acetone, ethyl acetate and higher esters, cellosolves.	Before mixing and catalyzing... Catalyzed 70-80° F ...	.. Stable indefinitely .. 24 hr.	All modifiers are included in resin as shipped.	40 to 47	[illegible] paste containing 50% benzoyl peroxide dispersed in tricresyl phosphate.	Anti-oxidants, vulcanized rubber	Knife coating Roller or transfer coating in special cases	Dissolve 4 parts paste catalyst in 100 parts resin.	
REICHHOLD CHEMICALS, INC.	Plyophen 5015	Straight phenolic resin	0.1325	60....	.. 40-75 at 25° C.	Mildly alkaline	Alcohol, acetone, compatible with a limited amount of water.	As shipped and up to 80° F........	.. 3 mo.	Extended with lignin or Vinsol up to 25% without materially affecting the properties.	45 to 50		Acid will inhibit cure; reacts with alkaline catalyst.	Dip tank with or without squeeze rolls. Spray	Resin solution used as received.	5-6
RESINOUS PRODUCTS AND CHEMICAL CO.	Paraplex P-10	Polyester resin	0.55	100	400 to 600 at 25° C.	Neutral	Aromatic hydrocarbons and chlorinated hydrocarbons, can dilute with limited amount of esters, ketones.	Absence of light, room temp., no catalyst .... With catalyst in closed container...	.. 12 mo. .. 4-7 days	Monomeric styrene and some rigid resins improve strength and rigidity.	35 to 45	Ultra-violet light. 1% benzoyl, 1.5% lauroyl or other peroxides.	Air, copper and copper alloys	Dip tank with squeeze rolls. Spreading Brush	Dissolve catalyst in P-10. Gentle warming (120° F.) will dissolve benzoyl peroxide more rapidly.	None. But all volatile is polymerizabl
	BV-16238	Phenolic resin		70	<3000 at 25° C.	Neutral	Ethyl alcohol, alcohol and water mixtures.	Below 70° F. Below 50° F.	.. 60 days .. 6 mo.		27 to 31			Dip tank Roller coating	Thin resin to viscosity desired for treating.	4-7
	BV-16887	Phenolic resin		70	<1000 at 25° C.	Neutral	Ethyl alcohol, alcohol and water mixtures.	Below 70° F. Below 50° F.	.. 60 days .. 6 mo.		27 to 31			Dip tank Roller coating	Thin resin to viscosity desired for treating.	4-7
BAKELITE CORP.	BV-17085	Phenolic resin		65	<500 at 25° C.	Neutral	Ethyl alcohol, alcohol and water mixtures.	Below 70° F. Below 50° F.	.. 60 days .. 6 mo.		27 to 31			Dip tank Roller coating	Thin resin to viscosity desired for treating.	Volat has sign fican
	BRS 16631	Unsaturated polyester		100	2000 at 25° C.	Neutral	Aromatic hydrocarbons	Below 70° F.	.. 60 days	Modified with styrene monomer.	35 to 40	0.5 to 3.0% benzoyl or lauroyl peroxide.		Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate.	Volat has sign fican
	BRS 17582	Unsaturated polyester		100	40,000 at 25° C.	Neutral	Aromatic hydrocarbons	Below 70° F.	.. 60 days	Modified with styrene monomer.	35 to 40	0.5 to 3.0% benzoyl or lauroyl peroxide.		Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate.	Volat has sign fican
	XRS-69	Unsaturated polyester		100	6000 at 25° C.	Neutral	Aromatic hydrocarbons	Below 70° F.	.. 60 days	Modified with styrene monomer.	35 to 40	0.5 to 3.0% benzoyl or lauroyl peroxide.		Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate.	Volat has sign fican

Knife coating Roller or transfer coating in special cases	Dissolve 4 parts paste catalyst in 100 parts resin.						Room 40° F.	.. 2-3 days .. 2 wk.	[illegible] Cellophane, 1% solution of Vejin A3 (centrifuged in benzene). Methyl or ethyl cellulose.	All standard types	[illegible] or non-porous surface. Plaster or concrete coated with Methocel or Ethocel.	All standard types	Contact	140.. then 176.. then 230.. 212.. 284..	.... ½ ....¼... ...⅛...	. 16 hr. then .. 2 hr. then .. 1½hr. . 90 min. .. 2 min.	
Dip tank with or without squeeze rolls. Spray	Resin solution used as received.	5-6	8-10	Drying tunnel	275	3-5 min.	Room	..4-6 mo.	Cellophane, stearic acid.	Platen press, hat press	Bag molding. Any type of mold		50 to 250	Without hardener and at 325 With hardener and at 325	...⅛... ...⅛... ...⅛... ...⅛...	. 10-12 min. . 45 min. 5-7 min. . 35 min.	
Dip tank with squeeze rolls. Spreading Brush	Dissolve catalyst in P-10. Gentle warming (120° F.) will dissolve benzoyl peroxide more rapidly.	Some. But all volatile is polymerizable.	High before gelation begins				Room temp.	..4-5 days	Cellophane, stearic acid, PVA	All standard types	All conventional types		Contact to 50	240	⅛	40 min.	No sign[ific]anc[e]. Flexi[ble] resi[n]
Dip tank Roller coating	Thin resin to viscosity desired for treating.	4-7	Flow content has no significance.	Usually dry in a continuous tunnel dryer.	285	10 min.	Wrap and protect from moisture and excess temperature.	30 days	Any of the conventional mold release agents.	All conventional types	All conventional types	All standard types	Contact and up to 50	275		15 min.	
Dip tank Roller coating	Thin resin to viscosity desired for treating.	4-7	Flow content has no significance.	Usually dry in a continuous tunnel dryer.	285	10 min.	Wrap and protect from moisture and excess temperature.	45 days	Any of the conventional mold release agents.	All conventional types	All conventional types	All standard types	Contact and up to 50	275		15 min.	
Dip tank Roller coating	Thin resin to viscosity desired for treating.	Volatile has no significance.	Flow content has no Significance.	Usually dry in a continuous tunnel dryer.	285	10 min.	Wrap and protect from moisture and excess temperature.	60 days	Any of the conventional mold release agents.	All conventional types	All conventional types	All standard types	Contact and up to 100	300		30 min.	
Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate.	Volatile has no significance.	Flow content has no Significance.					24 hr.	Bakelite XJ-17561	All conventional types	All conventional types	All conventional types	8 to 14	290		10 min.	
Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate.	Volatile has no significance.	Flow content has no significance.					24 hr.	Bakelite XJ-17561	All conventional types	All conventional types	All conventional types	8 to 14	290		10 min.	
Dip tank Roll coating Painting	Add 0.5 to 3.0% benzoyl or lauroyl peroxide and agitate.	Volatile has no significance.	Flow content has no significance.					24 hr.	Bakelite XJ-17561	All conventional types	All conventional types	All conventional types	8 to 14	240		10 min.	

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.... ½ .... .¼.... .1/16....	. 16 hr. then .. 2 hr. then .. 1½hr. . 90 min. .. 2 min.									0.035	3.4	0.065				Ducts, radar housing, aircraft parts, cabinets and panels, furniture.	Resin has a light amber color, doesn't darken with age. Resin comes in 3 parts, two liquid resins and catalyst paste.
.¼.... .½.... .¼.... .½....	. 10-12 min. . 45 min. 5-7 min. . 35 min.															High mechanical strength and temperature resistant laminates.	Resin comes as a natural and also as a black varnish. Addition of ¼-½% by weight of sodium hydroxide to resin solution gives a faster cure.
¼	40 min.	No signif-icance. Flexible resin		0.019	4.5	0.065	0.018	4.3	0.079	0.050	3.9	0.195	285 v/mil.	490 v/mil.	110 sec.	Electric insulation, decorative appli-cation, luggage, dielectric materials, lampshades.	Shrinkage on cure, 9%. Resin has a yellow cast. Polymerized P-10 is flexible but thermoset. Add to other low pressure resins of rigid type to improve impact strength of laminates. The liquid monomers are somewhat inflammable.
	15 min.															Building materials, airplane parts, luggage, furniture.	Shrinkage during cure 8-10%. Limited color possibilities. To obtain high surface finish it is advisable to give a second dip to a liner sheet and build resin content to 40%.
	15 min.															Building materials, airplane parts, luggage, furniture.	Shrinkage during cure 8-10%. Limited color possibilities. To obtain high surface finish it is advisable to give a second dip to a liner sheet and build resin content to 40%.
	30 min.															Building materials, airplane parts, luggage, furniture.	Shrinkage during cure 8-10%. Limited color possibilities. To obtain high surface finish it is advisable to give a second dip to a liner sheet and build resin content to 40%.
	10 min.									0.0075	4.57	0.034				Automotive applications, airplane parts, luggage, decorative panels.	Resin has slight yellow cast. Good color possibilities with pigments.
	10 min.									0.0102	4.49	0.046				Automotive applications, airplane parts, luggage, decorative panels.	Resin has slight yellow cast. Good color possibilities with pigments.
	10 min.									0.0096	4.48	0.043				Automotive applications, airplane parts, luggage, decorative panels.	Resin has slight yellow cast. Good color possibilities with pigments.

Laminac Resin...
Luggage compartment on American Airlines passenger transport lined with LAMINAC-laminated plastic paneling
Laminac panels produced by U. S. Rubber Company
Cyanamid Plastics
BEETLE* · MELMAC* · MELURAC* · LAMINAC* · URAC*

is Light for Flight

. . . and tough to scuff! That's why luggage compartments on commercial airliners are now being lined with LAMINAC* laminated plastic panels.

Formerly compartments were lined with aluminum, but when the metal became punctured from bumps or knocks, it tore and damaged luggage and cargo. Laminated paneling, however, has sufficient resiliency to absorb shock caused by "banging the cargo around." It is strong, tough, and durable. It not only eliminates costly replacement of damaged interior paneling, but gives extra protection to plane and cargo. Panels have no sharp corners—are lighter than metal.

LAMINAC laminates are available from your laminators in rigid or flexible sheets. The rigid flat sheets can be post-formed on inexpensive molds. Potential color combinations are unlimited since both color and design can be incorporated into the finished laminate during assembly of sheets of paper, cloth, Fiberglas, or other "fabric." This special feature enables this material to be used for walls, doors, counters, table tops, and many architectural facings.

Modern furniture, luggage, portable radios, and other products that must be attractive as well as easy to handle, suggest interesting possibilities for the use of laminates. We shall be glad to send you detailed information on LAMINAC, the plastic resin that can be readily adapted to many materials and products, or contact your laminator direct.

*Reg. U. S. Pat. Off.

AMERICAN CYANAMID COMPANY
Plastics Division
32 ROCKEFELLER PLAZA, NEW YORK 20, N. Y.

MELMAC PLASTIC INSULATING parts for speed regulators, brush holders, bushings, and washers are now being used instead of phenolic in all National Cash Register machines. High arc resistance prevents burn out from arcing caused by dust and oil. Saves replacement costs.

MELMAC PLASTIC 592 provides an extra margin of protection against flashovers, voltage surges, and shorts in heavy-duty relays made by the Allied Control Company. The dimensional stability of MELMAC 529 assures permanent alignment of the contacting surfaces.

The oil well cementing piece shown here was molded by Chicago Molded Products Corporation for the Halliburton Oil Well Cementing Company of Duncan, Oklahoma . . . Photo, courtesy of the Bakelite Corporation.

The Use of *Uniform* Claremont Cotton Fillers in Your Plastic Formulations Insures *Easier* Processing, Greater Strength, *Better* Products!

This rugged plastic section is heatronic molded of No. 926 Bakelite high impact-resistant phenolic molding material (compounded with Claremont Fabric Filler). It was directly responsible for Bakelite Corporation's being part recipient of the Hyatt Award for outstanding achievement — the application of electronic heating to thermosetting plastics.

Designed for oil well cementing and weighing over 12 lbs., the unit, formerly requiring one hour to mold, is now processed in ten minutes . . . a tribute to the free flowing qualities of Claremont Fillers.

In addition to Macerated Fabric Fillers, Claremont also produces Cotton Thread, Cotton Cord and Cotton Flock Fillers . . . all carefully graded, clean, uniform. Depending upon the strength factors required for your formulation, you can be certain that one of Claremont's four types will fill the specifications!

CLAREMONT WASTE MANUFACTURING CO.
CLAREMONT, • NEW HAMPSHIRE

Manufacture of Koresin in Germany*

by G. M. KLINE†

Koresin is a synthetic resin made by I. G. Farbenindustrie A.-G. during the war for use as a tackifier for synthetic rubber. The claims of the German technologists for Koresin as a superior tackifier for Buna S were substantiated by tests in this country and its manufacture was started in the United States during recent months for use with GR-S. The article "Resins from phenol and acetylene," on page 152 is a translation of a report on this subject.

KORESIN is a synthetic resin made by I. G. Farbenindustrie A.-G. during the war for use as a tackifier for synthetic rubber. The product is made by the reaction of acetylene (6 mols) and *p-tertiary*-butylphenol (5 mols) in the presence of zinc naphthenate, according to a reaction discovered by Dr. W. Reppe. The compound is thought to have the structure shown in Fig. 2 which appears further on in this article on page 184.

The resin is made in an autoclave lined with stainless steel although it is claimed that iron is satisfactory. The autoclave is built to withstand 300 atmospheres pressure. A flow sheet of this synthetic resin is shown in the diagram presented in Fig. 1.

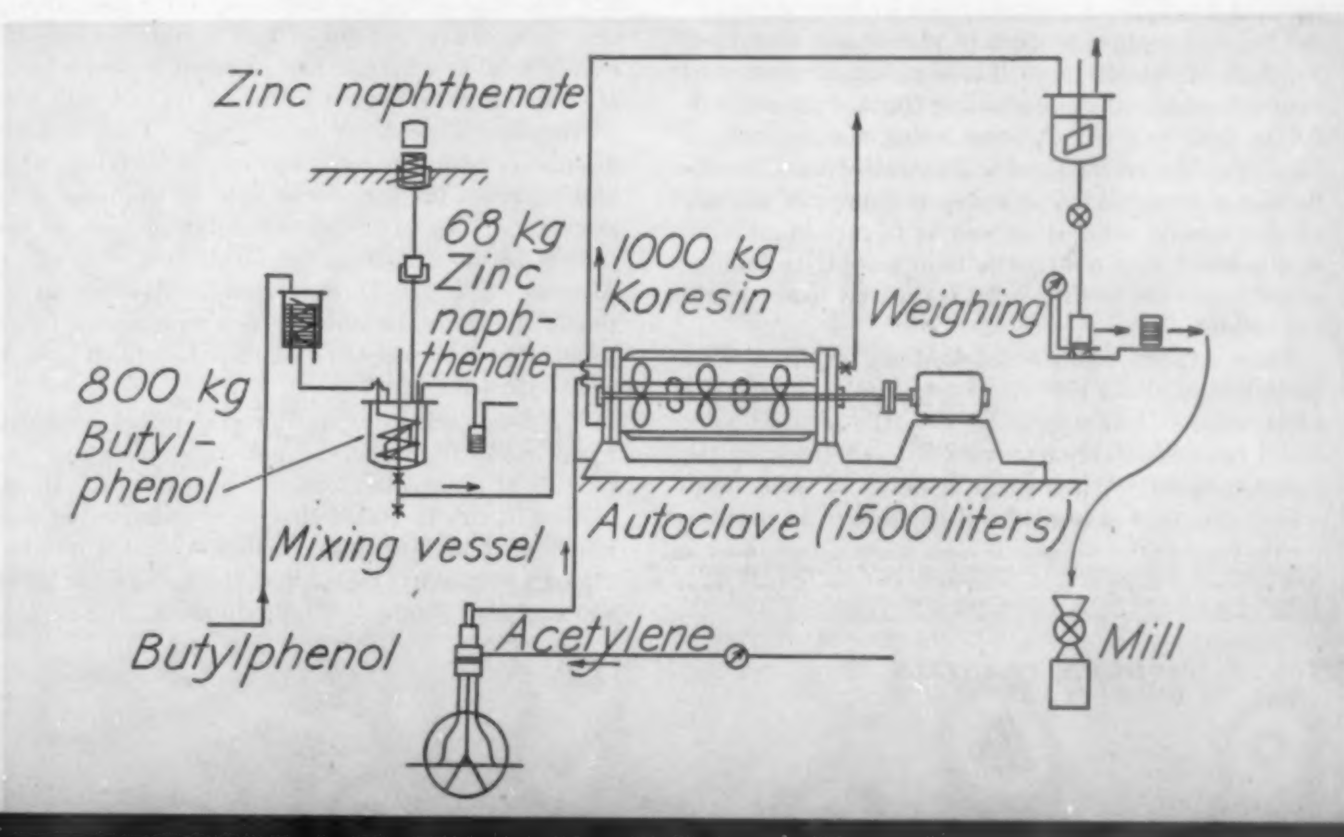
The *p-tertiary*-butylphenol is stored in heated tanks and conveyed through heated pipe lines to a measuring device which delivers the desired amount of the phenol to a steam-heated mixing tank. The catalyst—zinc naphthenate—is melted, measured and delivered to the mixing tank. The quantities for a single batch of this resin manufactured during the war by I. G. Farbenindustrie A.-G., are 800 kg. of the phenol to 68 kg. of zinc naphthenate.

(*Please turn to page 184*)

* Developments in the German plastics industry during the war have been thoroughly investigated by teams composed of technical representatives of the Ordnance Department, Quartermaster Corps, Chemical Warfare Service, Technical Industrial Intelligence Committee and other groups. The Department of Commerce is merely distributing this technical information which has come into its hands from captured German territory. This information should be made available to all United States citizens interested in it, but use of it by anyone must be and is at one's own risk in so far as the United States or foreign patent violations are concerned.

† Chief, Plastics Section, National Bureau of Standards.

1—*Flow sheet for the manufacture of this German developed resin*



Resins from phenol and acetylene*

Report presented at 23rd Kuko (Plastics Committee) meeting in Frankfort on Feb. 8, 1939, by Dr. Hecht, I. G. Farbenindustrie A.-G. This translation was prepared for publication by Mrs. I. G. Callomon and Dr. G. M. Kline, National Bureau of Standards

AMONG the large number of resins which can be produced from various phenols and acetylene, the most interesting on the basis of industrial utility are those made with phenol and *p-tertiary*-butylphenol, and next those made with cresols and *p,p'*-dihydroxydiphenyldimethylmethane. Zinc salts are the best catalysts, as has previously been reported in German Patents 642,886 and 645,112.

The following observations apply to monohydroxy multiple-ringed phenols:

1. With increasing length of side chain substituted in the phenol ring, the amount of acetylene which enters into the resin-forming reaction will increase.
2. The position of the substituted group in the phenol ring plays a role similar to that observed in the formation of the phenol-formaldehyde condensation products; the ortho-substituted phenol is the least reactive.
3. The amount of acetylene required to form a hard but easily soluble resin is 0.85 mol for phenol, about 1.2 mols for cresol and about 1.8 mols for *p-tertiary*-butylphenol.
4. For dihydroxy multiple-ringed phenols, the necessary amount of acetylene to yield resins which are readily fusible and soluble is considerably less, similar to the analogous phenol-formaldehyde condensation; for diphenolacetone 0.8 mol of acetylene is required for 1 mol of phenol component, that is, only about 0.4 mol of acetylene for each hydroxy group.

The condensation product of phenol and acetylene, which is of interest as a textile sizing, is most conveniently obtained by condensing 1 mol of phenol with 0.8 to 0.85 mol of acetylene, using zinc acetate as catalyst. We investigated in exhaustive tests the influence of temperature, acetylene pressure and amount of zinc acetate catalyst as well as of certain addition agents which were used partly to increase the solubility and decrease the melting point and partly to accelerate the reaction.

These experiments showed that the reaction takes place best at about 170° C. By adding small amounts of potassium hydroxide or amines, the melting point could be considerably decreased without changing the reaction speed. When small amounts of water were added (up to 4 percent), a decrease in the reaction speed was observed when the amount of water exceeded 0.5 percent. The best combination proved to be zinc acetate with addition of sodium sulfite (0.5 percent based on the amount of phenol). This yielded in numerous batches absolutely reproducible resins with an average softening range of 75 to 85° C. and very good solubility.

Resins from cresols and acetylene

Analogously, resins can be produced from technical cresols and acetylene. It is possible to produce from cresol DAB IV, which contains about 30 percent *m*-cresol, resins which are compatible with drying oils and alkyds; however, these products do not have good light fastness.

P-tertiary-butylphenol, which is also used with formaldehyde to produce Alkyphen (Kunstharz AP IV) has proved to yield an especially valuable product in reacting with acetylene. In a series of experiments we have systematically varied the ratio of butylphenol and acetylene. The best results have been obtained with a resin made with 1 mol of butylphenol and 1.5 mols of acetylene. In general, increasing the amount of acetylene reacted with the phenol component improved solubility in aliphatic hydrocarbons and compatibility with drying oils and alkyds. The condensation product made with 1 mol of butylphenol and 1 mol of acetylene, which is best produced with zinc naphthenate instead of zinc acetate because this resin is used as a lacquer raw material, becomes turbid after a time when cooked with tung oil and with heat-polymerized linseed oil (stand oil). This turbidity disappears with increasing amount of acetylene which also improves the fastness to light of the resin at the same time. The butylphenol-acetylene resin is very compatible with tall oil glyceride and the tall oil Alkydal (KN 120/3) developed in Uerdingen; it should, therefore, be suitable as a replacement for the rosin ester if it is necessary for the EL-varnish formulas to be changed.

The research is being continued to include especially resins made from the cheaper diphenolacetone or a mixture of diphenolacetone and butylphenol. In concluding, it can be stated that there remains the possibility of obtaining still further valuable products through systematic research in the field of the phenol and acetylene condensation products.

* The Department of Commerce is merely distributing this technical information which has come into its hands from captured German territory. This information should be made available to all United States citizens interested in it but use of it by anyone must be and is at one's own risk in so far as the United States or foreign patent violations are concerned.

Preparation of cross-linked polystyrenes*

Report presented at 26th Kuko (Plastics Committee) meeting in Ludwigshafen on Feb. 14, 1943, by Heinrich Hopff and Eric Eckardt, I. G. Farbenindustrie A.-G. Translation prepared by Mrs. I. G. Callomon and Dr. G. M. Kline, National Bureau of Standards

THE Army asked us, within the framework of another project, to produce cross-linked polystyrenes for an important purpose. The following agents were investigated: divinylbenzene, divinylacetylene, diallyl maleate, butyl acrylate and others. Divinylbenzene proved to be best suited for our purpose. Initially so-called technical divinylbenzene was used. Technical divinylbenzene is a mixture of mainly *m*- and *p*-divinylbenzene and small amounts of *o*-divinylbenzene. The variable mixture did not produce uniform products; therefore, we switched to pure *p*-divinylbenzene. This was produced by Dr. G. Hoffmann from diethylbenzene in the following manner: First, diethylbenzene is oxidized to diacetylbenzene; *p*-diacetylbenzene is easily separated by crystallization from the meta and ortho isomers; *p*-diacetylbenzene is converted to divinylbenzene by hydrogenation and subsequent splitting off of water. The resulting *p*-divinylbenzene is chemically pure.

Bulk polymerization

The experiments were carried out in the aluminum equipment developed for making Mowilith (polyvinyl acetate) in Hoechst. In the case of bulk polymerization the following difficulty developed: When styrene is heated with a cross-linking agent and a catalyst without stirring, an extremely violent reaction begins at about 100° C. This is caused by the high heat of reaction on the one hand and the poor conductivity of styrene on the other. The mass becomes so hot that the monostyrene starts boiling. The product foams and swells up and, in a short time, expands to 5 or 6 times the volume of the monostyrene. The reaction cannot be controlled; stirring is impossible because the substance being mixed becomes so viscous in a relatively short time that the stirrer cannot be moved any longer.

One-step process—In order to avoid the foregoing difficulties, the following method was tried: Styrene together with cross-linking agent and catalyst is gradually added to a kettle heated to 145° C. The product boils and polymerizes as it is added. The temperature can be regulated to a certain degree by the rate of addition of the styrene. After all of the styrene has been added, the polymerization is continued for 8 more hr. at 180° C. The finished product must be broken by hand to pieces about as big as a fist and then is reduced to small pieces of about 0.1 to 1.0 cm. size in a crusher. But with this method variable cross-linked products were obtained, possibly caused by temperature fluctuations during polymerization and by the impossibility of taking care of any localized overheating.

Three-step process—In developing the so-called three-step process we were guided by the following considerations: Monostyrene with cross-linking agent and catalyst added can be prepolymerized to 40 percent polystyrene in a stirred kettle at 60 to 65° C. without becoming solid. In this way it should be possible to obtain uniform products when operating under uniform working conditions.

Excess heat of reaction will be dispersed and conducted away by stirring, thus guaranteeing a uniform formation of polymerization nuclei and polystyrene molecules of similar chain lengths. Subsequent polymerization should take place under milder conditions. The latter assumption proved to be wrong. The substance foamed and swelled up at about 120° C. almost as much as in the one-step process. But when the 40 percent polymerized product was left overnight in the kettle, it became hard within 12 hr. without swelling. Heating the product to 70 to 75° C. before removal from the kettle brought the polymerization to 95 percent completion in 2 to 3 hours. Thereafter, it was only necessary to continue the polymerization for about 8 hr. at 160° C. to remove the last remnants of the styrene.

Based on these considerations and experiments, the following three-step production procedure was finally established:

First step: For the prepolymerization, styrene, to which the necessary amount of *p*-divinylbenzene and 0.5 percent of benzoyl peroxide has been added, is heated to 65 to 70° C. in a stirred kettle until the refractive index is 1.5660 at 24° C. Then the contents are heated to 70 to 75° C. and run into an iron vessel for further polymerization. This stage takes about 8 hours.

Second step: The mass in the vessel continues to react without any additional heat. The temperature increases to 146° C. (*Please turn to page 182*)

* The Department of Commerce is merely distributing this technical information which has come into its hands from captured German territory. This information should be made available to all United States citizens interested in it but use of it by anyone must be and is at one's own risk in so far as the United States or foreign patent violations are concerned.

Correlation between strength properties in test specimens and molded phenolic parts*

Part II. Impact properties of phenolic plastics

by P. S. TURNER and R. H. THOMASON†

This is Part II of a report on the work undertaken by the National Bureau of Standards to determine the relation between standard test and structural performance of molded plastics. The investigation was done for the National Advisory Committee for Aeronautics.

Part I, published in the May issue of MODERN PLASTICS magazine on pages 146 through 154, dealt with the tensile and flexural properties of ten selected types of phenolic molding materials. Some of the charts and tables referred to in this half of the article were published with Part I.

THE pendulum type of impact test has been found most useful for comparing the shock resistance of electrical insulating materials of generally similar composition and physical characteristics. The test is reported to be unreliable for indicating the relative shock resistance of materials which differ markedly in composition or mechanical properties.[8]

The Izod impact strength of the six phenolic molding materials are listed in Table IX in comparison with data taken from the Bakelite Technical Data Book. The discrepancy between the manufacturers' data and that obtained at the National Bureau of Standards for the macerated fabric-filled materials may depend on the capacities of the machines used.

The 4 ft.-lb. pendulum of the machine used at the National Bureau of Standards was barely sufficient to sever the specimens of BM-200 and BM-3510, although the capacity was three to four times the indicated breaking energy. The specimens which were not completely severed were left attached to the clamped portion by a few threads which acted as a hinge permitting the specimen to fold over out of the path of the pendulum. The other results are in good agreement. The impact strengths were consistently higher for specimens notched perpendicular to the ram motion compared with those notched parallel to the ram motion.

The energy expended in tossing the broken halves of the specimens amounted to about two-thirds of the Izod impact strength in the case of the woodflour-filled material, BM-45. The energy required to toss the broken halves of the specimens in all cases was proportional to the specific gravity of the material and amounted to 0.14 ft.-lb. per in. of notch per unit of specific gravity.

Since this amount of energy does not include any breaking energy, Izod impact strengths of 0.20 and 0.27, values frequently reported for cellulose-filled and mineral-filled materials, respectively, indicate little if any impact resistance. These values apply only to results obtained with the 2 to 4 ft.-lb. machine with standard specimens. Correcting the Izod impact strength for the tossing energy by subtracting a part of the tossing energy porportional to the residual energy of the pendulum after the Izod test, accentuates the differences between materials and between directions of testing. It throws little light on the actual differences between the impact resistance of the materials.

The work involved in breaking an unnotched impact bar in flexure is also reported in Table IX. The work to maximum load and the total work to break the specimens were determined from the areas of the load-deflection diagrams (Fig. 7). The areas were obtained with a planimeter. The work to maximum load does not show any consistent relationship to the Izod impact strength. The total work separates the fabric-filled materials from the others because of the large amount of work done after failure.

Hazen[9] reports that static bending tests give mineral-filled phenolic materials toughness ratings more nearly in agreement with ordinary experience, but that the test underrates the toughness of fabric-filled materials such as BM-3510. However, Hazen included only the work done to the maximum load in his ratings. He reported a value of 0.691 ft.-lb. per cu. in. for BM-3510 as compared with a value of 0.85 for work to maximum load obtained in this laboratory. The total work was about 1.5 ft.-lb. per cu. in., indicating that the energy

*Abridged from National Advisory Committee for Aeronautics Technical Note No. 1005.

† National Bureau of Standards.

[8] D. Telfair and H. K. Nason, "Impact testing of plastics. I. Energy considerations," Proc. A.S.T.M. 43, 1211–1219 (1943); MODERN PLASTICS 20, 85–88 (July 1943).

[9] T. Hazen, "Toughness of molding materials," MODERN PLASTICS 21, 103–106, 144 (Oct. 1943).

Table IX.—Izod Impact Strength of Molded Phenolic Materials

Material[a]	*Source of data*	*Location of notch*	*Capacity of pendulum*	*Izod impact strength*[b] *Average*	*Izod impact strength*[b] *S.E.*[f]	*Specific gravity of specimen*	*Tossing energy*[c] *average*	*Tossing energy divided by specific gravity*	*Impact strength*[d] *corrected for tossing energy*	*Work to rupture in bending*[e] *Work to maximum load*	*Work to rupture in bending*[e] *Total work*
			(*ft.-lb.*)	(*ft.-lb./in. of notch*)	(*ft.-lb./in. of notch*)		(*ft.-lb./in. of notch*)		(*ft.-lb./in. of notch*)	(*ft.-lb./in.*^{3})	(*ft.-lb./in.*^{3})
BM-45	NBS	Side[g]	2	0.274	±0.007	1.34	0.201	0.150	0.08	0.55	0.55
	NBS	Face[h]	2	0.344	±0.010	1.34	0.196	0.146	0.16	..	..
	Bak. Corp.[i]	Side	Unknown	0.26	...	1.35	...	...	..	..	..
BM-120	NBS	Side	2	0.304	±0.006	1.35	0.203	0.150	0.11	0.68	0.68
	NBS	Face	2	0.381	±0.010	1.35	0.191	0.141	0.19	..	..
	Bak. Corp.[i]	Side	Unknown	0.32	...	1.35	...	...	..	..	..
BM-6260	NBS	Side	2	0.339	±0.005	1.33	0.208	0.156	0.14	0.53	0.53
	NBS	Face	2	0.369	±0.005	1.33	0.199	0.150	0.18	..	..
	Bak. Corp.[i]	Side	Unknown	0.46	...	1.37	...	...	..	..	..
BM-250	NBS	Side	2	0.90	±0.02	1.91	0.257	0.135	0.68	0.43	0.65
	NBS	Face	2	1.06	±0.03	1.91	0.241	0.126	0.88	..	..
	Bak. Corp.[i]	Side	Unknown	1.0	...	1.89	...	...	..	..	..
Average tossing energy/specific gravity for 2 ft.-lb. pendulum—0.144											
BM-200	NBS	Side	4	2.34	±0.09	1.39	0.207	0.150	[j]	0.72	1.57
	NBS	Face	4	2.79	±0.011	1.39	0.201	0.146	[j]	..	..
	Bak. Corp.[i]	Side	Unknown	4.6[k]	...	1.37	...	...	..	..	..
BM-3510	NBS	Side	4	2.41	±0.08	1.38	0.209	0.152	[j]	0.85	1.53
	NBS	Face	4	2.78	±0.16	1.38	0.194	0.141	[j]	..	..
	Bak. Corp.[i]	Side	Unknown	3.8[k]	...	1.38	...	...	..	..	..
Average tossing energy/specific gravity for 4 ft.-lb. pendulum—0.147											

[a] Materials are listed in order of increasing bulk factors.
[b] Averages are for tests on 9 specimens.
[c] The energy to toss the severed ends was determined by fitting the specimen back together and repeating the test.
[d] The tossing energy was multiplied by the ratio of the residual energy after breaking to the capacity of the pendulum. This product was subtracted from the impact energy.
[e] Work to rupture unnotched impact bar at span-depth ratio of 8:1. Reported values are averages for two tests flatwise and two edgewise. The work per cubic inch was computed from the area of the load-deflection diagrams and the volume of material between the supports.
[f] S.E. = standard error.
[g] Side is the surface parallel to direction of ram motion.
[h] Face is the surface perpendicular to direction of ram motion.
[i] Data from Bakelite Technical Data Book.
[j] Corrected energy was not computed because specimens were not cleanly severed.
[k] Midpoint of range of reported values.

to tear the fabric-filled materials after failure may account for a large part of the measured impact strength.

Falling-ball impact test—The results of a progressive-repeated falling-ball impact test on 4-in. disks of BM-120 are given in Table X. The magnitude of the last impact in a series of impacts which caused failure is proportional to a power of the thickness between one and two. Since a number of other factors, such as the diameter-to-thickness ratio of the disks, the number of impacts and the velocity of the final impact are variable, the results are considered from a purely empirical viewpoint, assuming proportionality to the square of the thickness.

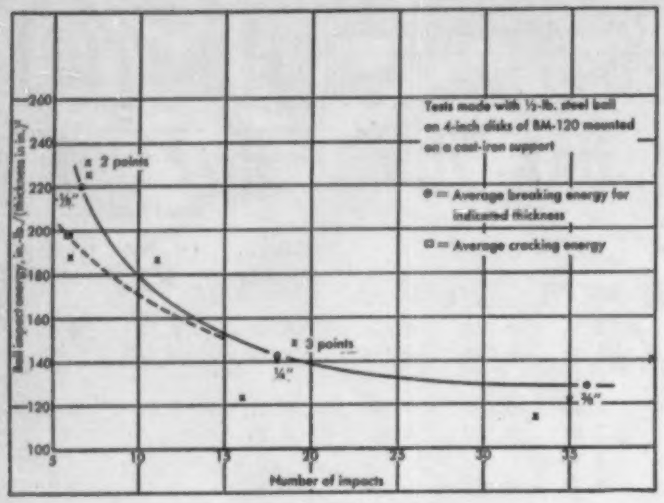
As long as comparisons are made between sheets of the same nominal thickness the exact relationship need not be known. The relationship between the magnitude of the final impact energy on this basis and the number of impacts is shown in Fig. 10. This curve shows a trend with thickness similar to that observed for flexural strength shown in Fig. 8.

On the basis of these results, similar progressive-repeated impact tests were made on rectangular sections cut from molded flat sheets of the six phenolic molding materials. The results of these tests are given

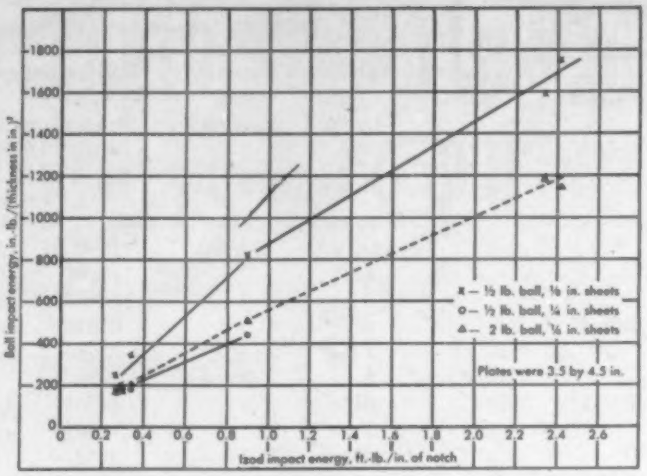
Table X.—Progressive-Repeated Falling-Ball Impact Test on 4 Inch Diameter Disks of BM-120

Test No.	*Thickness*	*Height of fall*[a]	*Energy to break specimen*[b]		
	in.	*in.*	*in.-lb.*	*in.-lb./in.*	*in.-lb./in.*^{2}
1	0.123	7	3.48	28.3	230
2	0.123	7[c]	3.48	28.3	230
3	0.124	7[c]	3.48	28.0	226
4	0.126	6[d]	2.98	23.7	188
5	0.170	11	5.47	32.2	189
6	0.251	18	8.95	35.6	142
7	0.253	19	9.44	37.4	148
8	0.253	19	9.44	37.4	148
9	0.253	16	7.96	31.4	124
10	0.253	19	9.44	37.4	148
11	0.379	35	17.40	46.0	121
12	0.379	33	16.40	43.3	114
13	0.380	40	19.90	52.4	138

[a] Also indicates number of impacts, since height of fall was increased from 0 in steps of 1 inch.
[b] Energy of last impact of series. Tests made with 0.497 lb. ball and with edges of the specimens supported on a 3.5 in. pipe cap.
[c] Cracked by impact of 2.98 in.-lb. in 6 in. fall.
[d] Cracked by impact of 2.48 in.-lb. in 5 in. fall.



10—*Relation of energy of final impact to break, in ball impact test, to number of impacts*



11—*Comparison of energy of final impact to break plates, in falling ball impact test, and Izod impact strength*

in Table XI. The series of impacts on the $^1/_4$-in. thick sheets with a 2-lb. ball caused failure at about the same impact energy per unit of thickness squared as a larger number of higher velocity impacts with the $^1/_2$-lb. ball.

The energy required to crack the tension side of the plates appears to be independent of the filler and consequently shows no correlation with the Izod impact strength. The degree of cracking required to define failure was arbitrarily chosen as the first visible crack. In the case of the fibrous materials, the widening of the crack occurred very gradually. The above conclusions could, therefore, be changed appreciably by a different interpretation as to when failure occurred.

The energy required to disrupt the specimens completely shows a very definite increase for increasingly fibrous materials. A comparison with the results of the Izod impact test is shown in Fig. 11. Since the cracking energy is practically constant for the different materials, it is apparent that high Izod impact strength indicated high tearing strength.

Impact-flexural test—This test was devised to evaluate the damage to the specimens of the long-fiber materials in the falling-ball test. Since the energy required to crack the specimens in the falling-ball test was practically independent of the filler, the different behavior of the materials must be attributed to their differing ability to sustain partial failure without total loss of strength. (*Please turn to page 158*)

Table XI.—Progressive-Repeated Falling-Ball Impact Test on Six Phenolic Molding Materials[a]

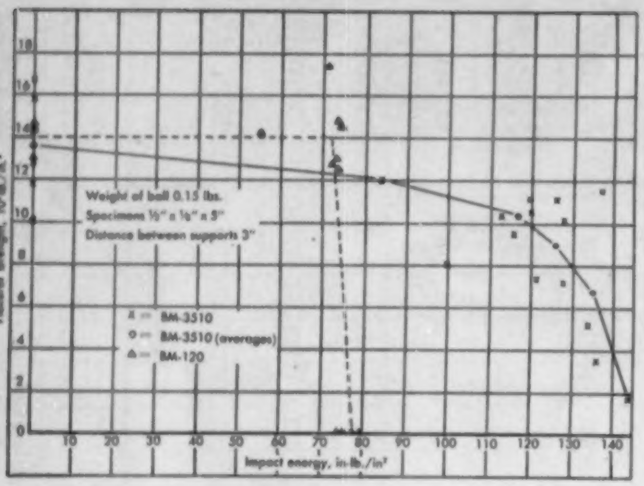
Material	*Weight of ball*	*Thickness of specimens*		*Energy to crack specimen*			*Energy to break specimen*		
		Average	*Range*	*Average in.-lb./thickness²*	*Range in.-lb./thickness²*	*No. of impacts*	*Average in.-lb./thickness²*	*Range in.-lb./thickness²*	*No. of impacts*
	lb.	*in.*	*in.*						
BM-45	0.497	0.141	0.124–0.151	194	174–226	7–8	245	218–291	9–10
	0.497	0.267	0.265–0.271	162	148–177	21–25	172	163–184	23–26
	1.977	0.266	0.256–0.278	167	151–179	5–7	177	151–200	5–7
BM-120	0.497	0.149	0.139–0.157	165	154–180	7–8	188	177–206	8–9
	0.497	0.316	0.304–0.327	176	167–188	31–38	181	172–193	32–39
	1.977	0.311	0.304–0.319	163	155–177	8	177	155–192	8–9
BM-6260	0.497	0.138	0.133–0.144	202	191–218	7–8	346	288–393	12–14
	0.497	0.270	2.263–0.280	147	139–152	21–22	182	171–194	26–27
	1.977	0.264	0.249–0.280	143	126–160	5	200	177–223	7
BM-250	0.497	0.133	0.129–0.138	227	209–239	8	825	725–885	25–34
	0.497	0.260	0.255–0.265	195	170–214	24–28	440	425–451	59–60
	1.977	0.269	0.259–0.278	154	147–162	5–6	509	460–538	18–20
BM-200	0.497	0.144	0.143–0.146	376	335–397	14–17	1590	1557–1627	65–68
	0.497	0.251	0.249–0.252	205	200–211	25–27	..	.....	...
	1.977	0.263	0.254–0.270	200	190–214	7	1180	1070–1280	35–46
BM-3510	0.497	0.134	0.129–0.139	194	180–209	7	1748	1633–1910	59–66
	0.497	0.257	0.249–0.265	189	184–192	24–26	..	.....	...
	1.977	0.277	0.276–0.279	198	182–208	7–8	1140	1120–1170	43–45

[a] Specimens $3^1/_2$ by $4^1/_2$ in. were supported at the edges in a wooden frame resting on a $^1/_2$-in. thick steel plate. A steel ball of the indicated weight was dropped on the center of the specimens from heights increased in intervals of 1 inch. Three specimens were used for each test.

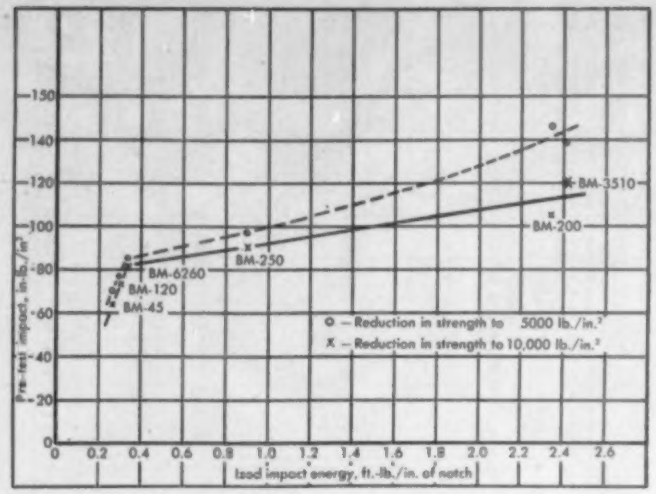
Table XII.—Comparison of Flexural Strengths of Specimens From Flat Sheets and Molded boxes
(Tests Made at Span-Depth Ratio of 8:1)

Material[a]	Specimens from 1/8-in. thick sheets: Thickness Average	Thickness Range	No. of tests	Flexural strength Average	Flexural strength Range	S.E.[b]	V[c]	Specimens from molded boxes: Thickness Average	Thickness Range	No. of tests	Flexural strength Average	Flexural strength Range	S.E.[b]	V[c]
	in.	in.		p. s. i.	p. s. i.	p. s. i.	%	in.	in.		p. s. i.	p. s. i.	p. s. i.	%
BM-45	0.141	0.124–0.157	17	11,900	11,100–14,700	±360	12.4[d]	0.131	0.126–0.134	18[e]	11,900	10,200–13,300	±210	7.6
								0.133	0.127–0.140	18[f]	12,400	11,200–14,000	±160	5.7
								0.119	0.111–0.127	21[g]	12,700	10,300–13,800	±170	6.2
								0.127	0.111–0.140	57[h]	12,300	10,200–14,000	±110	6.9
BM-120	0.162	0.144–0.175	10	14,200	12,600–17,400	±450	10.1[d]	0.131	0.128–0.135	18[e]	13,800	12,400–15,000	±150	4.6
								0.133	0.128–0.140	18[f]	12,500	10,900–14,000	±200	6.8
								0.123	0.117–0.131	21[g]	13,200	12,200–14,300	±130	4.4
								0.130	0.117–0.140	57[h]	13,100	10,900–15,000	±110	6.5
BM-6260	0.139	0.124–0.159	18	11,200	9,300–13,400	±240	9.0	0.138	0.132–0.149	18[e]	10,900	8,200–12,700	±270	10.4
								0.136	0.131–0.144	18[f]	11,600	9,300–13,300	±230	8.5
								0.120	0.113–0.127	18[g]	11,800	9,200–13,600	±320	11.3
								0.131	0.113–0.149	54[h]	11,500	8,200–13,600	±160	10.5
BM-250	0.136	0.120–0.145	18	12,600	9,300–15,100	±400	13.6	0.139	0.130–0.149	16[e]	6,980	6,000– 8,300	±160	9.4
								0.140	0.129–0.145	18[f]	8,590	6,700–10,500	±270	13.5
								0.117	0.109–0.124	20[g]	8,210	5,000– 9,600	±300	16.1
								0.131	0.109–0.149	54[h]	7,970	5,000–10,500	±170	16.0
BM-200	0.144	0.140–0.146	12	12,100	8,800–16,200	±600	17.3	0.133	0.130–0.136	18[e]	12,100	8,300–15,200	±400	13.9
								0.135	0.130–0.143	18[f]	11,800	9,200–17,800	±430	15.4
								0.120	0.114–0.128	20[g]	14,700	11,500–18,600	±380	11.7
								0.129	0.114–0.143	56[h]	13,000	8,300–18,600	±290	16.7
BM-3510	0.134	0.124–0.143	12	12,000	9,200–15,900	±600	17.5	0.132	0.128–0.137	18[e]	12,400	8,600–14,800	±320	11.8
								0.135	0.130–0.143	17[f]	12,900	10,500–14,600	±310	9.8
								0.129	0.124–0.138	21[g]	14,000	10,200–17,800	±440	14.3
								0.132	0.124–0.143	56[h]	13,200	8,600–17,800	±230	13.3

[a] Materials are listed in order of increasing bulk factors.
[b] S.E. = standard error of the mean.
[c] V = coefficient of variation.
[d] Warping of sheets of BM-45 and taper of sheets of BM-120 may be the cause of the higher variation in the flat sheet as compared with the boxes.
[e] Specimens from sides of boxes with long axis perpendicular to bottom.
[f] Specimens from sides of boxes with long axis parallel to bottom.
[g] Specimens from bottoms of boxes lengthwise and crosswise.
[h] Composite of all specimens from boxes.



12—*The effect of single falling-ball impacts on the flexural strength*



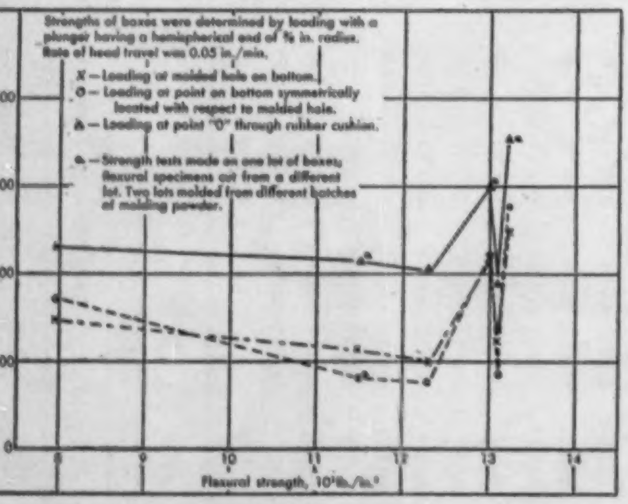
13—*Impact energy required to reduce flexural strength to a selected value compared to Izod impact strength*

The effect of single impacts on the flexural strengths of simple beams is given in Table XIII. Each impact value in the table represents tests on 14 to 21 specimens $^1/_2$ in. wide cut from the $^1/_8$-in. thick molded flat sheets. Most of these specimens received impacts close to or within the range of impacts which caused cracking. The short fiber materials BM-45, BM-120 and BM-6260 did not indicate a range of cracking energies but were either completely broken or not apparently damaged by the impact.

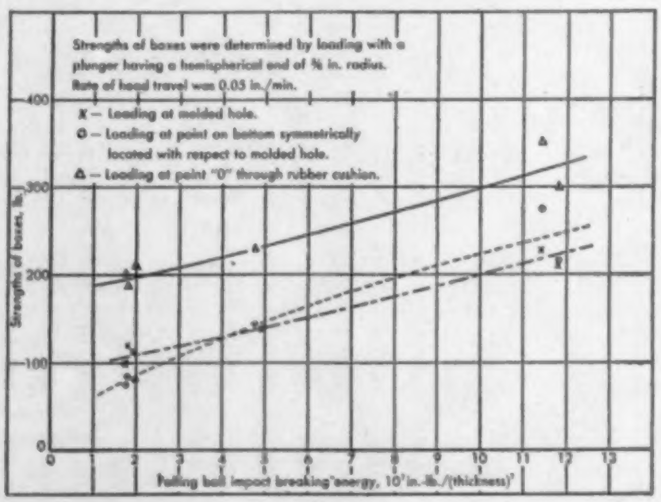
Table XIII.—Results of Impact Flexure Test on Six Phenolic Molding Materials

Material	*Mean bulk factor*	*Filler*	*Impact energy required to reduce flexural strength to* 10,000 p.s.i.	5000 p.s.i.
			(in.-lb./thickness²)	(in.-lb./thickness²)
BM-45	2.45	Woodflour	64	70
BM-120	2.58	Woodflour and cotton flock	73	76
BM-6260	3.8	Woodflour and cotton flock	79	85
BM-250	8.0	Asbestos fibers	90	97
BM-200	9.5	Macerated fiber	102	145
BM-3510	14.5	Macerated fiber	120	138

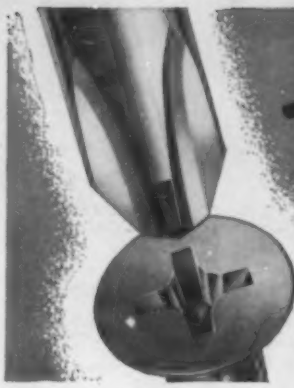
The flexural strengths, including zeros for specimens broken by the impact alone, were averaged in appropriate ranges of impact energies. The curves for BM-120 and for BM-3510, long fiber materials, are shown in Fig. 12. The impact energies, expressed in in.-lb. per thickness squared, required to reduce the average flexural strength to 10,000 and 5000 p.s.i., respectively, were determined graphically from curves of the residual flexural strength plotted against the impact energy. Comparison of these impact energies with the Izod impact strengths of these materials is shown in Fig. 13. (*Please turn to page 186*)



14—*Strengths of boxes compared with flexural strengths of specimens from boxes*



15—*Strengths of boxes compared with results of falling ball impact test on ¼-in. thick flat sheets*



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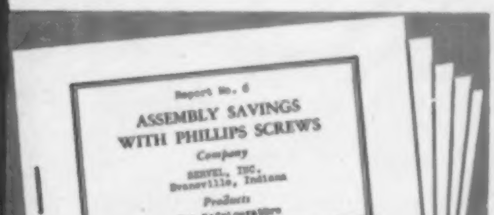

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General

DEVELOPMENT OF PLASTICS FOR PEACETIME TEXTILES. D. H. Powers. Am. Dyestuff Rep. *35*, 76–8 (Feb. 11, 1946). While the textile industry has always provided a large market for plastics, the study of their uses and applications in new fields during the war years appears to be opening far wider markets than ever before were envisioned. We find plastics being impregnated and incorporated into wool fiber to improve it and widen its fields of application. We find plastics as continuous films replacing fabrics and plastic fibers. We find plastics as binders, firmly attaching to the natural and synthetic fibers material which will impart greater mold, fire and water resistance; and a greatly increased percentage of our fabrics will be dyed and printed with colored pigments bound in with plastics. Finally, the sizing of warps and all types of yarn with plastics opens a new and large field for plastics.

METALLIC STEARATES. Witcombings *12*, 2–5, 11 (Apr. 1946). The uses of metallic stearates are described. The incorporation of 1 to 4 percent of a metallic stearate (calcium, lead, magnesium, etc.) in plastic compositions improves extrusion, sheeting and general processing characteristics. The stearate acts both as an internal lubricant and as a plasticizer. In addition, certain stearates act as heat stabilizers for plastics such as the polyvinyl chlorides. From $^1/_2$ to 3 percent lead stearate, frequently used for this purpose, has the effect of absorbing and neutralizing hydrogen chloride or other acid constituents split off at elevated temperatures. Plastics stabilized with lead stearate show less discoloration and maintain high electrical resistance needed for cable covering and electrical items.

PHYSICAL PROPERTIES OF RESIN-IMPREGNATED PLASTER. J. Delmonte. Trans. A.S.M.E. *68*, 241–6 (Apr. 1946). The impregnation of plaster of Paris with liquid thermosetting resins, and subsequent conversion of the product with heat, result in the formation of a material which is called "Plaspreg." The methods of producing this material with furane resins, its physical properties and applications are discussed. Resinified plaster is prepared from a low-cost base material, plaster of Paris.

WATER-RESISTANT TREATMENTS. R. A. Pingree. Am. Dyestuff Rep. *35*, 124–7 (Mar. 11, 1946). Various water-resistant treatments for textiles used in Germany are described.

CONSUMER PROTECTION. F. J. Tyrrell. Canadian Plastics *4*, 34–5, 57 (Jan. 1946). Common failures of consumers items made of plastics are discussed.

PRINTING INK RESINS. C. A. Knauss. Am. Ink Maker *23*, No. 10, 31–2, 51 (1945). This is a review concerning resins used in printing ink.

PLASTICS FROM PETROLEUM. H. R. Fleck. Plastics (London) *10*, 146–55, 168 (Mar. 1946). The production of unsaturated hydrocarbons from petroleum and their utilization in synthesizing plastic and synthetic rubber raw materials are reviewed.

Materials

LIGNIN-FILLED, LAMINATED-PAPER PLASTICS. Paper Trade J. *122*, 35–42 (Apr. 4, 1946). Paper Ind. & Paper World *27*, 1683–9 (Feb. 1946). The utilization of lignin in production of a laminated paper plastic was studied on a pilot plant scale. It was found that, with the exception of edgewise compressive strength a high temperature thermoplastic lignin-filled paper laminate of equal or superior strength to the conventional phenolic laminates can be made. The lignin-filled paper laminates have face Izod impact values three to six times greater than fabric- and paper-base phenolic laminates. The edge impact values are approximately equal to those of fabric-base laminates and three times greater than those of the conventional paper-base laminates. Both face and edge impact values are two to three times greater than corresponding values for papreg (a high-strength paper phenolic laminate), although other strength properties thus far obtained are somewhat less. Although lignin is thermoplastic it was found that the loss in tensile strength obtained when lignin-filled laminates are heated to 200° F. is not greater than that for thermosetting phenolic papreg. At low temperatures tensile strength of the lignin-filled laminate improves slightly over that measured at room temperature. There is some loss in impact strength both at high (200° F.) and at low (subzero) temperatures, but even at these temperatures the strength of the plastic compares favorably with that of other materials of this type even when they are measured under their most favorable temperature conditions. In addition to the use of lignin as a filler in laminating paper for plastics, it was found that it can be used as an extender for phenolic resins in impregnating varnishes for paper laminates. The process for manufacturing lignin-filled paper laminates comprises the following four steps: 1) isolation of lignin from spent liquors of the alkaline pulping processes; 2) incorporation of the lignin in a papermaking finish; 3) production of a moldable paper; and 4) conversion of the lignin-filled paper into a laminated plastic.

DICHLOROSTYRENES AND THEIR POLYMERS. E. E. Halls. Plastics (London) *10*, 117–24 (Mar. 1946). The properties of the dichlorostyrenes and their polymers are reviewed with particular reference to electrical equipment.

MICROCRYSTALLINE WAXES. B. H. Clary. Paper Ind. & Paper World *27*, 1679–82 (Feb. 1946). The manufacture, properties and uses in the paper industry of microcrystalline waxes are reviewed.

NEW MATERIALS AND TECHNIQUES BROADEN PLASTICS APPLICATIONS. Product Eng. *17*, 297–8 (Apr. 1946). The new materials and techniques in the plastics field are reviewed. Special articles on allyl resins, modified styrene resins, cellulose propionate, silicone materials, plastic-coated metal tubing, melamine molding compounds, polyethylene and nylon are included.

SILASTIC—THE HEAT-STABLE SILICONE RUBBER. P. C. Servais. Rubber Age *58*, 579–84 (Feb. 1946). The synthesis, properties, fabrication and applications of the silicone elastomers are described.

CYCLIC DIMETHYLSILOXANES. M. J. Hunter, J. F. Hyde, E. L. Warrick and H. J. Fletcher. J. Am. Chem. Soc. *68*, 667–72 (Apr. 1946). Cyclic dimethylsiloxane polymers, from three to eight units, were prepared and their physical properties are reported. These cyclic structures may be isolated either from the hydrolysis products of dimethylsilane derivatives or by destructive distillation of dimethylsiloxane high polymers. The phenomenally low molecular cohesion of dimethylsiloxanes compared with hydrocarbons is observed from surface tension values, vapor pressure data, and fluidity calculations.

SARAN COATING LATEX. G. W. Stanton and W. A. Henson. Modern Packaging *19*, 194–9 (Mar. 1946). Saran

film-forming coating latices offer a new way of applying the desirable characteristics of Saran resins to packaging materials. The compositions are applied with a simple water dispersion process, without the use of solvent, using existing machinery. They are indicated for applications to a variety of paper and paperboard materials to provide oil-and greaseproofness, chemical resistance, waterproofness, gloss and heat-sealability. In addition, free films and tapes have been cast from the latices.

WOODFLOUR-FILLED PHENOLIC RESINS IN TROPICAL CLIMATES. H. Gerland. Plastics (London) *10*, 137–40 (Mar. 1946). The effects of various chemicals likely to be encountered in the deterioration of woodflour-filled phenolic plastics on metal inserts and molded plastic were investigated. The chemicals used included ammonia, acetic acid, formic acid, salts of formic and acetic acids, formaldehyde, phenol, cresol, magnesium compounds and hexamethylenetetramine. For tropical use, woodflour-filled phenolics should have a resin content of 50 percent or more, low magnesia content and no excess of hexamethylenetetramine.

ACETYLATED COTTON HIGHLY RESISTANT TO ROTTING. C. F. Goldthwait, J. McLaren and S. T. Voorhies, Jr. Textile World *96*, 115–17, 212, 216 (Feb. 1946). Partial acetylation of cotton fabrics and yarns increases resistance to mildew attack, and changes the dyeing characteristics, but does not affect the physical properties appreciably. The process of partial acetylation is described.

EFFECT OF ALKALINE PULPING ON THE ACETYLATING PROPERTIES OF WOOD PULP. J. W. McKinney. Paper Trade J. *122*, 58–62 (Jan. 24, 1946). The extreme haziness of solutions of cellulose acetate prepared from purified pulps cooked by alkaline processes is well known. In a search for the cause of this haze, the effects of modifications of the kraft pulping conditions on the final acetylation clarity were investigated. The modifications in kraft cooking procedure studied included low-temperature cooks, variations in the sulfidity of the cook, and alkaline pretreatment of the chips. No improvement in acetylation clarity resulted from the application of these methods. However, a mild precook with sulfite cooking acid or with dilute sulfuric acid resulted in a great reduction in the amount of haze. But if this sequence is reversed, with the sulfite cook following the kraft cook, there is no improvement in clarity. In order to determine whether haze-producing substances were formed from cellulose itself under alkaline pulping conditions, relatively pure cellulose in the form of cotton linters was cooked with kraft liquor under conditions substantially the same as those used for wood. No increase in haze was noted. A possible explanation of these facts based on the formation of anhydro-hemicelluloses during an alkaline cook is advanced.

Applications

USE OF POLYMERS TO MAKE WOOL UNSHRINKABLE. I. ANHYDROCARBOXYGLYCINE. A. W. Baldwin, T. Barr and J. B. Speakman. Soc. Dyers & Colourists *62*, 4–9 (Jan. 1946). The usual methods of making wool unshrinkable depend for their success on the formation of a gelatinous degradation product of keratin on or under the surface scales of the fibers. The fiber travel responsible for shrinkage is thus prevented, but unshrinkability is obtained at the expense of wear resistance. It is clearly desirable that masking of the scales should be brought about by depositing substances on the surface of the fibers, instead of by superficial degradation of the wool itself, but the use of ready-made polymers for this purpose is not always satisfactory because the surface films are removed from the wool in every day use, especially in laundering. Attention has therefore been turned to the possibility of building up films of polymer on the reactive side-chains of wool fibers by means of suitable monomers. Anhydrocarboxyglycine seems to be ideal for this purpose, because polymerization is initiated by water, and the treated fibers, being coated with what is essentially a protein film, should retain the characteristic properties of wool apart from an inability to undergo milling shrinkage. The optimum conditions for making wool unshrinkable by means of anhydrocarboxyglycine were found to be treatment at 50° C. for 6. hr. with 5 percent of the reagent (on the weight of the wool) dissolved in ethyl acetate to which 2 percent of water (by volume) had been added, the liquor-wool ratio being 33:1. As a result of this treatment, the fabric increases in weight by about 4 percent and shows little tendency to shrink in soap or acid milling. Unshrinkability is due to masking of the surface scales of the fibers by a film of polymer, which also prevents fiber movement by causing local adhesion of fibers to one another. When formed out of contact with wool, the polymer resists solution in a wide range of solvents. For this reason the unshrinkable finish conferred on wool by anhydrocarboxyglycine is unimpaired by treatment with hot organic solvents. In addition, the polymer may be anchored to the fibers by reaction with the basic side chains because 1) the unshrinkability of treated fabric persists after extraction with a concentrated solution of lithium bromide, in which the free polymer is readily soluble, and 2) deaminated wool is incapable of being made unshrinkable by means of anhydrocarboxyglycine. A further advantage of the anhydrocarboxyglycine finish is that the resistance of wear of the treated wool is greater by more than three times that of the untreated wool.

WESTERN-MADE PLASTICS PRODUCTS EARN A SECURE PLACE IN MULTI-MILLION-DOLLAR PHOTO INDUSTRY. Pacific Plastics *4*, 17–20 (Feb. 1946). Applications of plastics in photographic equipment are described.

SELLING THE HOBBYIST. M. Dobert. Plastics (Chicago) *4*, 74–6 (Feb. 1946). The use of plastics by the hobbyist for making objects at home is described.

Coatings

BEHAVIOR OF PLASTICIZERS IN NITROCELLULOSE FILMS. H. L. Tuthill. Paint, Oil and Chem. Rev. *108*, No. 25, 7–10, 40–1 (1945). The compatabilities of several plasticizers with a large number of film-forming resins and lacquer oils were determined. Load-elongation curves of cellulose nitrate films containing various amounts of plasticizers were obtained before and after exposure to a variety of aging conditions. The flexibilities at various temperatures were also found.

HEAT-REACTIVE HYDROCARBON RESINS AND OILS. W. J. Sparks, J. D. Garber and O. C. Slotterbeck. Am. Paint J. *30*, No. 7, 54–9 (1945). Hydrocarbon resins are made with various degrees of unsaturation. These heat-reacting materials are being evaluated for use in the manufacture of protective coatings.

SILICONES—NEW TYPES OF VARNISHES. W. S. Penn. Paint Manuf. *15*, 364–6, 370 (1945). The properties of coatings based on the silicone resins are described. Possible applications are in electrical insulation and coatings for use in tropical conditions.

ALKYD RESINS IN MARINE FINISHES. G. Leffingwell and M. A. Lesser. Marine News *32*, No. 5, 73, 138–41 (1945). The applications of alkyd resins in marine finishes are reviewed. 18 references.

SCIENTIFIC UTILIZATION OF COAL AND ITS IMPORTANCE TO THE PAINT INDUSTRY. F. C. B. Marshall. J. Oil & Colour Chem. Assoc. *29*, 3–13 (Jan. 1946). The chemicals and resins derived from coal and their application in the paint industry are discussed.

MEASURING COVERAGE AND FILM THICKNESS OF PRINTING INK AND PAINT FILMS. R. Buchdahl and M. F. Polglase. Ind. Eng. Chem., Anal. Ed. *18*, 115–17 (Feb. 1946). The coverage or the thickness of ink and coating films, which are applied to paper, metal, wood and plastics, is determined by adding tracer materials to the film-forming materials. One type of tracer is a dyestuff; another is a radioactive isotope. The thickness is calculated from the amount of dyestuff which is extracted from the coated material or from measurements of the radioactivity of the coated material.

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Technical Briefs

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Engineering

PROTECTING ELECTRONIC EQUIPMENT FROM FUNGI. P. Pollack. Plastics (Chicago) *4*, 60, 62, 96–7 (Feb. 1946). The problem of fungi attack on plastics is discussed.

INDUSTRIAL USES OF ALKALI LIGNIN. E. B. Brookbank. Paper Trade J. *122*, 44–6 (Mar. 28, 1946). In considering uses for alkali lignin, knowledge of its physical and chemical properties suggests a number of possibilities. It has been extensively studied as an ingredient of thermosetting phenolic resin compounds. Various methods for incorporation of the lignin into the resin were studied, but with few exceptions, all efforts resulted in a small but definite decrease in quality of the finished product, without materially reducing cost. This lignin is extensively used as the organic expander in the negative plates of lead-acid storage batteries. Today, the majority of automobile batteries manufactured in the United States use this material, with marked success. It is effective as an emulsifier for asphalts and is compatible with asphalts of certain types to a high degree. It has been used successfully for preparation of asphalt emulsions, and when added to high-melting asphalts in small amounts, materially reduces cold flow. Many other possible uses for alkali lignin have been explored or are in course of development. A few of these are: in printing inks, as a carrier for insecticides, as a means of conditioning boiler water for prevention of scale and caustic embrittlement, and for removing iron from water supplies.

FILM PROPERTIES AND UTILIZATION OF RESIN-STARCH. C. C. Kesler, J. E. Killinger and E. T. Hjermstad. Paper Trade J. *122*, 39–43 (Mar. 28, 1946). Studies of moisture sorption and shrinkage on drying of films of starch and other materials showed that although the amount of shrinkage is limited to some extent by moisture retained, wide variations in shrinkage were observed by materials whose films may retain approximately the same percentage of moisture. High shrinkage values were obtained with starches from which amylose may be obtained, and low values from starches which yield little or no amylose upon fractionation. Treatment of corn starches with urea-formaldehyde resin reduced shrinkage of their films, depending on amount of resin used. Use of the starch-resin reaction product resulted in a number of advantages. Coating, tub and calender sizing operations verify the validity of film studies as a measure of the suitability of materials for production of desirable end uses. Clay coatings gave good wax tests and printability, high gloss and, if desired, increased coating weights. Actual tub sizing operations showed increased bursting strength and fold resistance, greatly increased porosity and oil absorption values, higher gloss and smoothness and improved erasure and pen and ink values. Calender applications, where less pick-up results, gave improved surface characteristics with pronounced improvement in scuff test both wet and dry.

STEELS FOR THE PLASTICS INDUSTRY. British Plastics *18*, 109–14 (March 1946). The types of steels used in the plastics industry for making molds and hobs are reviewed.

HIGH-STRENGTH PLASTICS IN FUTURE AIRCRAFT DESIGN. W. I. Beach. Mechanical Eng. *68*, 225–32 (March 1946). Low-pressure molded laminated plastic structures for aircraft are considered. The properties of these materials are discussed. The results of loading tests on a wing molded of a glass fabric laminate are reported.

Chemistry

PHOTOGELATION OF RUBBER SOLS IN THE ABSENCE OF ACCELERATORS. R. Buckingham and G. V. Planer. J. Soc. Chem. Ind. *65*, 6–8 (Jan. 1946). On irradiation of rubber sols with ultraviolet light in the absence of oxygen, gelation takes place under certain conditions. The nature of this reaction was studied by following its progress by means of viscosity measurements. Reaction curves determined for rubber sols in carbon tetrachloride, in the absence of accelerators, were found to be fundamentally of the same type as those obtained in their presence. They differed, however, in showing a slight initial decrease in viscosity owing to degradation, probably due to traces of oxygen. Mechanism and structures of reaction products are discussed.

INTRODUCING FOREIGN END GROUPS IN VINYL POLYMERIZATIONS. C. C. Price and D. H. Read. J. Polymer Research *1*, 44–8 (Jan. 1946). Dichloroquinone and dichlorohydroquinone act as chain transfer agents rather than inhibitors when added to styrene polymerizations. They thus resemble chloranil rather than benzoquinone and hydroquinone. Attempts to place labeled foreign end groups at each end of polystyrene molecules, using p-bromobenzoyl peroxide as a catalyst and nitrobenzene dinitrobenzene, or nitrothiophene as retarders, were only partially successful. Two to four times as many retarder fragments were incorporated in the polymer as catalyst fragments. This behavior is ascribed to weak chain transfer characteristics in the retarder molecules.

MECHANISM OF FORMATION AND STRUCTURE OF PHENOL-ALDEHYDE PLASTICS. A. A. Vansheĭdt. Trudy Konferentsiĭ Vysokomolekulyar. Soedineniyam, Akad. Nauk S.S.S.R., Otdel. Khim. Nauk i Otdel. Fiz. Mat. Nauk *1*, 20–1 (1943); Chem. Abstracts *40*, 494 (Jan. 20, 1946). The results of pyrolysis and viscosity studies of solutions show that the novolak formed from phenol and formaldehyde contains no branched chains. An isonovolak formed by condensing phenol with bis-hydroxymethylol-phenyl methane has branched chains and has twice the viscosity of novolak solutions. Treatment of alkaline solutions of novolak with formaldehyde results in the formation of methylol derivatives. The methylol compounds are converted to resols and resites by heat. In resol formation, water forms from the hydroxyl group and aromatic hydrogens and from two hydroxyl groups.

COVALENT ADSORPTION ON BASE-EXCHANGE RESINS. I. THE ADSORPTION OF MONOBASIC ACIDS. J. A. Bishop. J. Phys. Chem. *50*, 6–12 (Jan. 1946). The adsorption on basic resins of acids of widely varying strength was studied, and an equation suggested by which such adsorptions may be correlated by regarding the process as one of salt formation. Different amounts of adsorption are thus a result of varying degrees of hydrolysis of the salts formed. In concentrated solutions direct adsorption of molecules may produce greater adsorption than the equation predicted.

Properties

PLASTIFICATION AND RESISTANCE TO COLD. O. V. Sedlis. Trudy Konferentsiĭ Vysokomolekulyar. Soedineniyam, Akad. Nauk S.S.S.R., Otdel. Khim. Nauk i Otdel. Fiz.-Mat. Nauk *2*, 85–103 (1944); Chem. Abstracts *40*, 494 (Jan. 20, 1946). The more pliable plastics retain this pliability at lower temperatures than the more brittle plastics. Homo-

geneous high molecular weight polymers with little tendency to crystallize have the best cold resistance. Incorporating active plasticizers in the plastics improves cold resistance but lowers insulating capacity and strength. The addition of alkyl stearates improves resistance to cold. Mechanical plastification by stretching above the softening range is also effective in improving resistance to cold.

X-RAY STUDIES OF THE STRUCTURE OF PLASTICS. W. T. Astbury. Soc. Dyers & Colourists *62*, 3 (Jan. 1946). This is a summary of a lecture. The X-ray patterns of phenol-formaldehyde resin, polystyrene, methyl methacrylate resin, vinyl chloride acetate resin, nylon, polyethylene, polyethylene fibers, quenched polyethylene, contracted vinyl chloride acetate resin, unstretched polyisobutylene and polyvinyl alcohol fibers are described and illustrated.

SOME EFFECTS OF DRY HEAT UPON THE PROPERTIES OF NYLON FABRICS. Am. Dyestuff Rep. *35*, 38–42 (Jan. 14, 1946). Nylon shrinks when heated, and this shrinkage can be fixed by the use of dry heat. The higher the temperature of treatment or the longer the time, the more permanent the "set." Nylon can be damaged by dry heat. This damage is indicated by a loss of tensile strength and elasticity. The fiber is also made more yellow in color by higher temperatures. Heat-treated nylon fabrics can be dyed without forming creases in the fabric, provided temperature of pretreatment is sufficiently high. Some dyestuffs dye heat-damaged nylon to a greater depth than undamaged nylon, whereas other dyes show a loss in color value with increasing temperature of pretreatment.

THERMAL EVIDENCE OF CRYSTALLINITY IN LINEAR POLYMERS. W. O. Baker and C. S. Fuller. Ind. Eng. Chem. *38*, 272–7 (March 1946). Unusually sharp differences between physical states at molding or fabricating temperatures and those at use temperatures are striking properties of newer thermoplastics such as polyethylene and polyamides. This report shows that such polymers, unlike polystyrene, methacrylates and many cellulose derivatives, show relatively sharp phase transitions on cooling from a fluid state. These transitions resemble the setting of an ordinary crystalline organic material; this explains the large shrinkage on molding these compounds. However, supercooling can be extensively induced and controlled and utilized technically for appreciable times, whereas it is very unstable with small molecules. Temperature-time studies show phase transitions which support thermodynamically and extend the structural evidence for local order or "crystallinity" in typical classes of linear polymers, including polyethylene, polyesters and polyamides. The ease of crystallization of linear polymers from a molten or disordered phase is greater the lower the average molecular weight and the less the chain interaction of specific atomic groups, such as dipoles. Crystallization in polydisperse polymers does not depend on ordering of a limited range of molecular species. It seems to include the imperfect participation of all chain lengths, the longer chains on the average becoming least well ordered. This required special thermodynamic concepts for polymer "crystals." The crystallite size of, for example, polypiperazine sebacamide is so small that there is no visible clouding, hazing or light scattering, but a definite first-order phase transition appears when the polymer solidifies. However for cellulose derivatives which are crystalline by X-ray and polarized light measurements, no thermal transition has yet been found. Thus cellulose derivative crystallite size may represent a small number of chains.

Testing

LABORATORY TESTING OF PLASTICS BY A SMALL-SCALE FLEXURE TEST. O. W. Ward and A. Bailey. A.S.T.M. Bull. No. *138*, 33–6 (Jan. 1946). A method and apparatus for testing the flexural strength of plastics quantitatively was developed which yielded reproducible and accurate results on specimens of about 1 gram. The apparatus and method of molding the required small beams of rectangular cross-section, and the apparatus and method of testing these beams are described and illustrated. Strength values for various plastics were determined by the reduced-scale test and the results tabulated. The precision of the method was of the order of one percent and the accuracy was similar. The method permitted more rapid and economical experimental research on plastics by eliminating the preparation of quantities of material in small-scale apparatus and by yielding test results on the change of one variable through a complete time-range from a single experiment.

METHOD OF NOTCHING IMPACT TEST SPECIMENS. S. E. Siemen. A.S.T.M. Bull. No. 139, 45 (Mar. 1946). A method of machining the notches in impact test specimens is described. The cutter consists of a single tool bit with a cemented carbide insert which is ground to the desired notch dimensions.

Synthetic rubber

SYNTHETIC RUBBER MECHANICAL PARTS IN PRESENT AND POSTWAR VEHICLES. E. F. Riesing. India Rubber World *112*, 59–64, 66, 186–190, 313–16 (April, May, June 1945). The static, dynamic and permanence properties of synthetic rubber mechanical parts for vehicles are discussed in detail. The topics include operating temperatures, tension modulus at operating temperature, resilience, efficiency, low-temperature flexing, resistance to ozone, acid, ultraviolet light and gas diffusion, electrical resistivity, resistance to oils and coolants, static and dynamic compression and shear modulus, hysteretic and elastic properties, creep and relaxation, change in modulus with time, and synthetic rubberlike elastomers. Fifty-seven references.

ADHESION OF RUBBER TO BRASS PLATE. W. A. Gurney. Rubber Chem. & Tech. *19*, 199–207 (Jan. 1946). Trans. Inst. Rubber Ind. *21*, 31–40 (June 1945). The factors affecting the adhesion of rubber to brass were investigated. The theory that the brass-plate bond depends on chemical interaction, and that this is opposed by the vulcanization of the compound, not only explains the practical requirements for efficient bonding, but accounts for the complexities of the problem. For consistent bonding to be maintained, at least four variables have to be under control, and suited to one another, viz., vulcanization properties of rubber, nature of brass, total cure, and molding conditions. It is not surprising that the process has a reputation for being erratic, if these are not properly controlled.

SINGLE-CORD COMPRESSION ADHESION TEST FOR EVALUATING THE ADHESION OF VULCANIZED RUBBER TO CORD. E. T. Lessig and J. Compton. Rubber Chem. & Tech. *19*, 223–32 (Jan. 1946). Of the two recognized types of adhesion, mechanical and specific, the former seems to be a more apt expression in the case of cord adhesion to elastomers. Certainly in contrasting differences in adhesion of untreated cotton cord and continuous filament rayon cord, the greater adhesion of the former must be attributed to greater mechanical interlocking at the rubber-fabric interface. This conclusion is substantiated by the fact that staple rayon cord adheres to natural rubber almost as tenaciously as does cotton cord. In the case of adhesive-treated cotton and rayon cord, mechanism of the adhesion to rubber is best explained by the mechanical concept, modified, however, in that the high-modulus cord and the low-modulus rubber are bonded by an intermediary-modulus, mutually compatible, adhesive bridge. This bonding of adhesive to cord has some of the aspects of being specific, but this is probably largely mechanical also. Credance that the "step-off" in modulus principle is responsible for the effectiveness of most cord adhesives is found in the fact that, without exception, cured films cast from adhesives which are effective in bonding elastomers to cord have higher moduli than elastomer compounds to which the cord is adhered. The adhesive film or material is often able to change the modulus of the elastomer compound in the vicinity of the cord by changing the state of cure, and in this way a similar result of modulus gradation is obtained.

U. S. Plastics Patents

Copies of these patents are available from the U. S. Patent Office, Washington, D. C., at 10 cents each.

VINYL HALIDE POLYMERS. F. K. Schoenfeld (to B. F. Goodrich Co.). U. S. 2,395,344, Feb. 19. Vinyl halides are heated at a temperature favoring the production of soluble polymers, cooled to a temperature favoring the production of insoluble polymers before appreciable polymerization has occurred and continuing polymerization at reduced temperatures.

INTERPOLYMERS. W. H. Sharkey (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,395,347, Feb. 19. Sulfur-containing esters of hydrolyzed interpolymers of ethylene with a vinyl ester of an organic carboxylic acid.

WRINKLE VARNISH. W. A. Waldie (to New Wrinkle, Inc.). U. S. 2,395,360-1, Feb. 19. A wrinkle varnish base is prepared by melting an oil-soluble rosin-modified phenol-aldehyde resin in linseed oil at 580° F., adding an additional amount of linseed oil to the melt, maintaining the temperature at 400° F. and blowing with air until a predetermined viscosity is attained.

ETHYLENE POLYMERS. L. Squires (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,395,381, Feb. 19. Interpolymers of ethylene and vinyl acetate are prepared by reacting in the presence of an oxygen compound at a pressure above 800 atmospheres by passing ethylene through a series of zones involving compression, drying, cooling, mixing, compression and reaction, compressing the ethylene to between 20 and 150 atmospheres, drying, cooling under pressure to condense, introducing vinyl acetate, and subsequently compressing to between 300 and 800 atmospheres.

SYNTHETIC YARN. R. F. Conaway (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,395,396, Feb. 26. High tenacity filaments, yarns and threads are produced by applying to cellulose derivative filaments, prior to heat treating, a liquid comprising an inert solid having a melting or softening point above the stretching temperature of the filaments, and heat-treating to soften the filaments while retaining the solid thereon so as to prevent sticking of filaments while they are soft.

CONDENSATE. M. DeGroote (to Petrolite Corp., Ltd.). U. S. 2,395,400, Feb. 26. A polymerized condensation product obtained by heat polymerization in the presence of an alkaline catalyst of a polyethylene amine and a high molecular weight monocarboxylic acid.

CELLULOSE ESTERS. R. W. Nebel (to E. I. du Pont de Nemours & Co., Inc..) U. S. 2,395,421, Feb. 26. The solution viscosity of organic esters of cellulose is reduced by washing a freshly precipitated cellulose organic acid ester, containing combined mineral acid, with water having a hardness of at least 20 parts per million and containing sufficient mineral acid combined with the cellulose to lower the pH of the water to a value not less than 4.5.

GASKET LINING. J. E. Robinson and P. W. Millelot, Jr. (to American Can Co.). U. S. 2,395,502, Feb. 26. A gasket lining composition consisting of a homogeneous mixture of alcohol soluble zein, cellulose nitrate, glycol phthalate, titanium dioxide, carbon black, and coloring matter.

COPOLYMERS. L. C. Rubens and R. F. Boyer (to Dow Chemical Co.). U. S. 2,395,504, Feb. 26. A liquid polymerizable mixture comprising a monovinyl aromatic compound and dehydrated castor oil.

ALKYD RESINS. R. K. Iler, G. H. Latham and J. W. Robinson (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,395,550, Feb. 26. A fatty oil modified alkyd resin, a polysilicic acid and a lower monohydric saturated alcohol.

COPOLYMER. H. J. Richter (to E. I. du Pont de Nemours & Co., Inc.). U. S. 2,395,581, Feb. 26. A composition, comprising a copolymer of vinyl chloride and a neutral ester of a saturated alcohol and fumaric acid modified with an alkoxyalkyl ester of an aliphatic dicarboxylic acid, which is resistant to cracking at −50° C.

SHOE SOLE. L. W. Rollins (to United Shoe Machinery Corp.). U. S. 2,395,582, Feb. 26. A leather shoe outsole reinforced by a plurality of pegs of plastic material extending through the body thereof.

POLYVINYL ALCOHOL. C. Dangelmajer (to Resistoflex Corp.). U. S. 2,395,-616, Feb. 26. A normally flexible plasticized polyvinyl alcohol composition containing as a thermostabilizing agent a sulfate of copper or iron.

POLYMERS. W. W. Prichard (to E. I. du Pont de Nemours & Co., Inc). U. S. 2,395,642, Feb. 26. Fusible polymers are prepared by heating a hydrazide of a dicarboxylic acid in which the carboxyl groups are attached to aliphatic carbon atoms at a temperature sufficient to cause evolution of water, heating until an intrinsic viscosity of at least 0.1 is attained, and discontinuing the heating before the evolution of substantial quantities of basic nitrogenous materials.

ADHESIVE TAPE. W. Kellgren and W. D. Hurd (to Minnesota Mining & Manufacturing Co.). U. S. 2,395,668, Feb. 26. In a roll of pressure-sensitive adhesive tape an interwound liner of creped paper impregnated and coated with a fused homogeneous non-bleeding composition comprised of ethyl cellulose, hydrogenated castor oil and a higher fatty acid.

PHENOLIC RESIN. H. J. Luth (to Brunswick-Balke-Collender Co.). U. S. 2,395,675, Feb. 26. A cast ball of phenolic resin is cured and hardened by enclosing in an elastic jacket, subjecting to vacuum to remove entrapped gases, subjecting to heat in a liquid under pressure at a temperature of 270 to 280° F., removing the jacket, machining the ball, rejacketing, subjecting to vacuum to remove gases, heating to 230 to 240° F. while immersed in a liquid at 2000 to 6000 p.s.i.

PHENOLIC RESIN. H. J. Luth and K. J. Gregory (to Brunswick-Balke-Collender Co.). U. S. 2,395,676, Feb. 26. Phenol and formaldehyde are condensed in the presence of an alkaline catalyst to form an aqueous condensate containing 2 to 2.3 mols of formaldehyde for each mol of phenol, an aqueous solution of barium hydroxide is added, sulfuric acid is added in a quantity just sufficient to react with the barium hydroxide and suspend barium sulfate in the medium, acidifying the mass and distilling until the barium sulfate becomes invisible to the unaided eye.

VINYL ETHER POLYMERS. C. E. Schildknecht (to General Aniline and Film Corp.). U. S. 2,395,684, Feb. 26. The heat resistance of a polyvinyl ether is improved by finely dispersing therein an alkali or an alkaline earth metal sulfide or polysulfide.

LIPSTICK HOLDER. J. W. Anderson. U. S. 2,395,709, Feb. 26. A lipstick holder composed of plastic material.

ANIMAL FIBERS. J. F. Cowley to (Tootal Broadhurst Lee Co., Ltd.). U. S. 2,395,724, Feb. 26. Textile material containing animal hair is treated with a synthetic resinous substance in order to decrease its tendency to felt.

CONTAINERS. W. B. Ford. U. S. 2,395,731, Feb. 26. Cylindrical containers are lined with a coating of a plastic hardenable substance by rotating the container having a charge of coating material so that coating is uniform and removing excess material before it sets.

(Please turn to next page)

The Core of the Case . . . Molded in PLASTICS

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Few plastic product problems are tough enough to take the one-two-three punch of the experienced modern molder — precision mold building . . . knowledge of the nature and use of plastic materials . . . modern equipment and production methods. It's the kind of punch that TECH-ART can deliver for you. Let's talk your problems over.

TECHNICAL NOTES: The two tolerance problems mentioned above involved (1) close dimensions for the hinge openings yet sufficient wall thickness to prevent cracking (2) tight tolerances for the groove intended to grip the lining fabric.

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RESIN. A. B. Hersberger (to Atlantic Refining Co.). U. S. 2,395,739, Feb. 26. A resin is produced by simultaneously reacting an aromatic hydrocarbon with an aldehyde and a polycarboxylic acid or an anhydride thereof in the presence of a condensing agent at a temperature conducive to the reaction.

WOOL TREATMENT. E. C. Pfeffer, Jr., and W. Kitaj (to Cluett Peabody and Co., Inc.). U. S. 2,395,791, Feb. 26. Wool is stabilized against laundry shrinkage by treating with an alcoholic caustic solution and then with an aqueous solution of a resin-forming material and curing latter.

POLYMERS. H. Gudgeon and R. Hill (to Imperial Chemical Industries, Ltd.). U. S. 2,395,812, March 5. Process comprising polymerizing in aqueous emulsion an alkyl ester of 1-carboxybutadiene-1,3.

ION EXCHANGE. J. C. Hesler (to Infilco, Inc.). U. S. 2,395,825, March 5. Salts are removed from water by treating it first with a hydrogen exchange body and then with an anion removal body comprising insoluble guanidyl aldehyde resin.

POLYSTYRENE. W. A King (to Allied Chemical and Dye Co.). U. S. 2,395,829, March 5. Polystyrene is subjected to pyrolysis at a temperature above 350° C. and a pressure of 350 mm. of mercury, the decomposition products being removed immediately after formation.

ORGANOSILICON COMPOUNDS. J. S. Kirk (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,395,880, March 5. Partially esterified polysilicic acid liquid compositions having a ratio of ester groups to silicon atoms of 1:2 to 2:1 and having greater stability against gelling than the unesterified polysilicic acids, the preparation comprising mixing a monohydric alcohol and a solution of a low molecular weight polysilicic acid and removing water while maintaining the acidity equivalent to a pH of 1 to 3.

COATING. W. F. May (to American Can Co.). U. S. 2,395,894, March 5. A taste-free flexible coating for sheet metal containers comprising in combination a phenol-aldehyde resin which is heat convertible, plasticized and modified by a polyvinyl acetal resin of an aliphatic aldehyde, and as solvent a mixture of a liquid aromatic hydrocarbon and a ketone.

COATING. W. F. May (to American Can Co.). U. S. 2,395,895, March 5. A coating composition is prepared by milling together a coumarone or indene resin with an isobutene polymer and applying to metallic surfaces while in molten state.

TEXTILE TREATMENT. W. D. Timmons. U. S. 2,395,922, March 5. Textile materials are fire-proofed and glow-proofed by impregnating with coumarone-indene resin and a water-insoluble oxide or sulfide of antimony.

COATINGS. W. T. Walton and J. W. Eysenbach (to Sherwin-Williams Co.). U. S. 2,395,925, March 5. Varnish bases are prepared by reacting an acidic resin having free carboxyl groups with a polymerized unsaturated oil having drying characteristics and containing saturated fatty acids and unpolymerized fatty acid substances and strongly blowing with an inert gas to remove volatile constituents.

STUFFING BOX PACKING. R. E. Morgan and P. N. Curry (to Durametallic Corp.). U. S. 2,395,935, March 5. A corrosion-resistant packing comprising a strip of polyvinylidene chloride foil twisted to form a core and a strip of silver foil impregnated with finely divided graphite wrapped around said core.

THERMOSETTING RESIN. J. L. Haas (to Hodgman Rubber Co.). U. S. 2,396,098, March 5. A thermosetting composition capable of being compounded like natural rubber comprising a plasticized polyvinyl butyral, a heat-hardening resin such as a phenol-aldehyde resin capable of reacting with the polyvinyl butyral and zinc oxide.

PATENT LEATHER. J. R. Price (to Carbide and Carbon Chemicals Corp.). U. S. 2,396,125, March 5. Simulated patent leather comprising polyvinyl chloride-acetate containing 95 percent vinyl chloride, polyvinyl chloride-acetate containing 87 percent vinyl chloride, a heat stabilizer, a lubricant, a plasticizer and a pigment.

PLASTICIZERS. E. A. Rodman (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,129, March 5. Plasticizers comprising the reaction products of corn oil blown to a viscosity of 35 to 50 seconds and phthalic, or maleic acids or their anhydrides.

CELLULOSE ESTERS. M. L. Ernsberger and A. S. Gregory (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,-165, March 5. An improved cellulose ester in fiber form is prepared by dry spinning a solution in an organic solvent of a cellulose acetate crotonate, ε-thiocaprolactam, dibenzyl tetrasulfide, and sulfur and heating the resulting fiber for 8 hr. at 150° C.

POLYACETALS. W. H. Sharkey (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,209, March 5. An acetal of a hydrolyzed interpolymer of ethylene with a vinyl ester of an organic carboxylic acid.

POLYXANTHATES. W. H. Sharkey (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,210, March 5. A xanthate of a water-insoluble hydrolyzed interpolymer of a vinyl ester of an organic carboxylic acid with another polymerizable compound containing a single double bond is prepared by reacting an alkali metal alkoxide with the hydrolyzed interpolymer to form an alkali alcoholate and thereafter reacting the alcoholate with carbon disulfide in order to form the polymeric xanthate.

POLYMERS. R. E. Christ (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,248, March 12. Polymers are prepared by heating at reaction temperatures below 180° C. a mixture of a monoaminomonohydric alcohol in which the amino nitrogen carries at least one hydrogen and which has a chain of less than four atoms separating the amino and hydroxyl groups, and a dibasic carboxylic acid having a radical length of at least six and then heating the low molecular weight polymer at polymerizing temperatures to form a polymer to be made into pliable filaments.

COPOLYMERS. W. C. Smith (to Standard Oil Development Co.). U. S. 2,396,293, March 12. A composition consisting of a copolymer of a vinyl aromatic compound such as styrene, α-methylstyrene, *p*-methylstyrene or α-methyl-*p*-methylstyrene with a conjugated diolefin, a polymerized iso-olefin having a molecular weight of 60,000 to 200,000 and a wax.

COATED ARTICLE. J. J. Brophy (to United Shoe Machinery Corp.). U. S. 2,396,313, March 12. A shoe part having a single sprayed temporary protective coating comprising a vinyl resin and a plasticizer therefore formed *in situ* directly upon it, said coating being readily peeled from the part after subjecting the part to various manufacturing operations.

WATERPROOFING. A. B. Quick. U. S. 2,396,342, March 12. A waterproofing composition comprising chlorinated rubber, a polyterpene resin, a water-insoluble and water-repellent metal soap, a fatty glyceride plasticizer, and a volatile solvent.

STABILIZERS. F. W. Cox (to Wingfoot Corp.). U. S. 2,396,555–6–7, March 12. Polyvinyl acetals are stabilized with 8-hydroxyquinoline, the tartrate of hexamethylenetetramine, or N,N′-dicyclohexyl ethylenediamine.

COPOLYMERS. J. R. Long (to Wingfoot Corp.). U. S. 2,396,586, March 12. A copolymer of an aliphatic conjugated diene hydrocarbon and an α- (ω-carboalkoxyalkyl)-acrylonitrile.

DISPERSIONS. T. H. Rogers, Jr. (to Wingfoot Corp.). U. S. 2,396,607, March 12. A calking compound is prepared by heating a polyvinyl acetal to a temperature of 185° F., adding a dispersing agent comprising a mixture of casein and sodium oleate and adding water in an amount sufficient to form a dispersion containing from 45 to 70 percent solids.

PASTE. K. Thinius (to Alien Property Custodian). U. S. 2,396,621, March 12. A paste consisting of a mixture of a polyurethane melting at 188 to 190° C. prepared by condensing α, ω-hexanediisocyanate with 1,4-butylene glycol, 3-chloro-

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POLYTETRAFLUOROETHYLENE. J. Alfthan and J. L. Chynoweth (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,629, March 19. Articles are prepared from polytetrafluoroethylene by subjecting finely divided particles of said resin to pressure to form a shaped body, heating at 300 to 327° C. until the body is above 300° C., heating above 327° C. until sintered, the rate of increase of temperature not exceeding 35° C. per hr. to below 300° C. and thereafter cooling at a rate of 80° C. per hr. to 250° C.

POLYETHYLENE. M. M. Brubaker (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,677, March 19. In the polymerization of ethylene the reaction is carried out in aqueous medium in the presence of an organic peroxide catalyst and in the absence of a dispersing agent at a pressure above 300 atm. and at a temperature of from 50 to 250° C.

ORGANOSILICON POLYMERS. P. J. Garner (to Imperial Chemical Industries, Ltd.). U. S. 2,396,692, March 19. Allyl, isobutenyl, crotonyl or furyl esters of silicic acid are polymerized by heating in liquid phase at 180 to 280° C. under at least autogenous pressure.

ALKYD RESINS. E. C. Haines (to Geo. D. Weatherill Varnish Co., Inc.). U. S. 2,396,698, March 19. Fatty oil modified alkyd resins are prepared by continuously intermingling the reacting ingredients at elevated temperatures so as to maintain a constant ratio of reactants and reaction products.

HALOGENATED ETHYLENE POLYMERS. E. L. Martin (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,713, March 19. The copolymerization product of tetrafluoroethylene, a perchlorofluoroethylene containing at least two fluorine atoms and a hydrogen-containing halogenated ethylene.

PLASTICIZER. F. C. McGrew (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,715, March 19. Synthetic polyamides are plasticized with para organic carboxylic alkyl ester substituted phenol.

POLYOLEFINS. W. E. Hanford (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,785, March 19. Ethylene and mono- or polyolefinic compounds are copolymerized by heating between 40 and 186° C. in a hydrocarbon solvent and in the presence of a per compound catalyst at a pressure above 35 atm.

POLYMERS. W. E. Hanford (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,786, March 19. A mixture of linear polymeric materials with nitrogen groups substituted for hydrogen on aromatic carbon of linear polymeric materials.

ETHYLENE POLYMERS. N. W. Krase and A. E. Lawrence (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,791, March 19. Ethylene polymers are prepared by continuously passing ethylene into a reaction zone at a temperature between 40 and 400° C. and a pressure between 800 and 4000 atm., dropping the pressure after discharging from the reaction zone to between 150 and 500 atm., recompressing gases after separation from the polymer, and returning them to the reaction zone.

THIAZOLES. J. K. Simons (to Libbey-Owens-Ford Glass Co.). U. S. 2,396,894, March 19. A reaction product of an aldehyde with a substituted thiazole.

POLYETHYLENE. A. T. Larson (to E. I. du Pont du Nemours and Co., Inc.). U. S. 2,396,920, March 19. In the polymerization of ethylene, the reaction is carried out in the presence of from 0 to 50 parts per million of molecular oxygen and a per-oxy compound at a temperature of 40 to 350° C. and a pressure of 300 to 1500 atm. in a deoxygenated aqueous medium.

BUTTON. W. F. Reibold and R. P. Magnenat (to Waterbury Companies, Inc.). U. S. 2,396,930, March 19. A plastic button.

POLYMER TREATMENT. W. A. Lazier and F. K. Signaigo (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,957, March 19. Monomeric dithioglycidol is brought in contact with a polymeric material until at least a portion of the sulfur has become bound to the polymer.

POLYMERS. C. W. Mortenson (to E. I. du Pont de Nemours and Co., Inc.). U. S. 2,396,963, March 19. A polymeric ketone having a molecular weight of at least 1000, having multiple recurring structural units containing a ketone carbonyl group and a number of recurring units containing at least one β-cyanoethyl group on a carbon contiguous to the ketone carbonyl.

CELLULOSIC SHEETS. O. W. Frost and G. S. Willey (to United States Gypsum Co.). U. S. 2,396,996, March 19. A method for bending cellulosic sheets, comprising passing through heated rolls and locking against a mandrel.

POLYMERS. C. F. Fryling (to B. F. Goodrich Co.). U. S. 2,396,997, March 19. A monomeric material such as styrene or an acrylic acid ester is polymerized in the presence of a sulfur containing polymerization modifier.

MOLDING. F. C. George. U. S. 2,396,999, March 19. A machine for molding blocks from plastic material.

PHENOL-FORMALDEHYDE. J. W. Kroger and H. F. O'Connor (to F. H. Levey Co.). U. S. 2,397,018–9, March 19. A non-resinous stable liquid condensate of phenol or its alkylated products with formaldehyde, said liquid being free of formaldehyde, retaining its fluidity at room temperature, but being converted to hard resin at elevated temperatures, said resin being useful as a vehicle for pigment in printing inks.

COATING. C. Dreyfus and B. Andersen (to Celanese Corp. of America). U. S. 2,397,093, March 26. A coating for imparting moisture impermeability, comprising a solution of polystyrene, a wax, another thermoplastic resin, and as plasticizer the distillate from polymerized α-methyl-p-methylstyrene distilled at a temperature of 147 and 184° C. and a pressure of 1 mm. of mercury.

ABRASIVE WHEEL. G. J. Goepfert and R. H. Rushmer (to Carborundum Co.). U. S. 2,397,101, March 26. A resin-bonded abrasive wheel comprising abrasive grains bonded with a heat-hardened resin and a sheet of a fabric impregnated with a heat-hardened resin.

SHEET MATERIAL. E. H. Land (to Polaroid Corp.). U. S. 2,397,149, March 26. A transparent sheet, the central portion comprising a polyvinyl alcohol derivative chemically transformable to polyvinyl alcohol, an integrally formed layer on each surface comprising molecularly oriented polyvinyl alcohol, each layer and the core merging together, the merging boundary comprising copolymer molecules of the derivative and polyvinyl alcohol.

INJECTION MOLDING. E. G. Touceda. U. S. 2,397,168, March 26. A method for making dies for the injection molding of plastics.

COATING. H. J. Wolfe (to American Can Co.). U. S. 2,397,179, March 26. An oleo-resinous metal surface coating is prepared by cooking a varnish type resin in a fast-drying oil of high iodine value at an elevated temperature until solution is obtained and incorporating into the solution normal trialkyl phosphate, the latter serving as a powerful wetting agent.

SYNTHETIC RESINS. G. H. Miller. U. S. 2,397,194, March 26. A liquid thermosetting resin adhesive composition comprising the resinous condensate obtained by heat-reacting a mixture of ingredients consisting of aqueous formaldehyde, urea, and aqueous ammonia in an open vessel at a temperature of 95 to 100° C. for from 25 to 35 min.

TERPENE DERIVATIVE. A. L. Rummelsburg (to Hercules Powder Co.). U. S. 2,397,205, March 26. A resinous reaction product which comprises heating an acyclic terpene hydrocarbon having three double bonds with an aldehyde such as formaldehyde at a temperature between 50 and 275° C. in the presence of a catalyst such as an inorganic acid, an unsubstituted organic carboxylic acid or an organic sulfonic acid.

ETHYL CELLULOSE...
WORTHY MATE FOR METAL

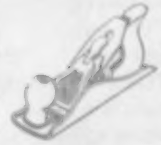
toughness plus for tools or electric mixers, flashlight housings or faucet handles

For the "Hallowell" Tool Kits, as for many products where plastics must share the strains imposed on integral metal parts, ethyl cellulose (Lumarith E. C.) provides an unequalled combination of toughness and other properties—plus the economy of high-speed injection molding. It was selected only after many different plastics were tested.

Outstanding among thermoplastics in impact strength, lightweight, dimensional and temperature stability, colorability, moisture and chemical resistance, and electrical properties, ethyl cellulose here affords a unique handle-housing that will withstand the severest use and abuse.

If ethyl cellulose could give *your* products these many extra selling advantages, why not investigate now? This valuable plastic is now released from war demands and readily available.

Ethyl cellulose mixer housings have high impact and dielectric strength



Ethyl cellulose tool handles are rugged, colorful, and pleasant to the touch

Ethyl cellulose flashlight cases, proved best for Army use, now first civilian choice

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CELLULOSE ACETATE
CELLULOSE NITRATE
ETHYL CELLULOSE

For general-purpose production plastics

Hercules does not make plastics or molding powder, but supplies the high-quality cellulose derivatives from which they are made. For data, please write to

HERCULES POWDER COMPANY INCORPORATED 916 Market Street, Wilmington 99, Delaware

CP-48

Books and Booklets

Write directly to the publishers for these booklets. Unless otherwise specified, they will be mailed without charge to executives who request them on business stationery.

The chemistry of the carbon compounds. Vol. III, The aromatic compounds, 3rd edition

by Victor von Richter and Richard Anschutz, Translation by A. J. Mee

Published by Elsevier Publishing Co., Inc., 215 Fourth Ave., New York, N. Y., 1946

Price $15.00 794 pages

This translation of the 12th edition of the famous German treatise on organic chemicals provides a convenient source of information on the aromatic compounds which enter into the manufacture of synthetic resins. The properties of the various derivatives are given together with the reference to the original publication. A comprehensive index facilitates the location of data pertaining to each compound.

G. M. K.

Colloid chemistry. Theoretical and applied. Vol. VI. General principles and specific industries. Synthetic polymers and plastics

Edited by Jerome Alexander

Published by Reinhold Publishing Corp., 330 W. 42nd St., New York, N. Y., 1946

Price $20.00 1215 pages

The 71 papers by selected contributors which are included in this volume fall into two groups, 38 papers dealing with specific industries or industrial operations and 32 papers with plastics. The latter cover cellulose derivatives, thermoplastic and thermosetting resins, and proteins.

The papers on plastics differ greatly in their merits. Some are excellent surveys of the chemical and colloidal aspects of the materials complete with bibliographies; others are merely sketchy reviews of the commercial aspects with no references. The contributions in the section, which deal with new and modernized industrial tools and methods, are uniformly thorough in their treatment of these subjects.

G. M. K.

● The Power Piping Div., Blaw-Knox Co., Pittsburgh, Pa., has issued an illustrated brochure on the company's Supertherm system of process heating which consists of drawing water, at steam saturated temperatures, from any standard boiler and circulating it through a closed pipe system using a specially designed pump. As applied to the molding of plastics, the system is said to cut costs and simplify the maintenance of uniform temperature.

● Burring, finishing and polishing with Brightboy, an elastic-rubber compound impregnated throughout with abrasive, is the subject of Catalog 57 prepared by Weldon Roberts Rubber Co., Brightboy Industrial Div., Newark, N. J. The book will have special interest for manufacturers of plastics products as it discusses the cleaning of molds and removal of flash.

● "The business man's guide to electronics," publication of the Electronic Tube Sales Department, Westinghouse Electric Corp., Bloomfield, N. J., tells "what electronics can do for you" in the fields of induction heating, dielectric heating, control and regulation, power conversion, inspection and others.

● The "transmuted wood" process by which inferior grades of various softwoods can, by impregnation with urea and dimethylol-urea resin, be transformed into products that are said to surpass hardwoods in many ways is described in a folder just released by Badger Paper Mills, Inc., Peshtigo, Wis.

● Printloid, Inc., New York 12, N. Y., has just published a booklet entitled "Four steps in plastics production," which presents in graphic terms the company's facilities for forming, printing, die cutting, machining, design and assembly. A glossary of thermoplastic materials, their trade names, properties and applications is given.

● Technical data on Mycalex have been compiled in an illustrated catalog by the Plastics Division, General Electric Co., Pittsfield, Mass. Properties charts and blueprints supplement descriptions of recommended practice for molding, fabricating and machining the material.

● An attractively illustrated booklet published by B. F. Goodrich Co., Akron, Ohio, outlines the applications, forms and properties of "Koroseal—the modern flexible material for industry." Particularly stressed are industrial uses and the material's resistance to destructive elements of various types.

● "Five formulas for improved packaging and a short story on merchandising," a leaflet prepared by the Plastics Division of Monsanto Chemical Co., Springfield, Mass., gives the packaging possibilities of Vuepak, Fibestos, Lustron, Resinox and the company's heat sealing materials. An accompanying spiral-bound booklet displays samples and uses of thicknesses of Vuepak varying from .005 to .020 inch.

● The facilities, services and products of Surprenant, Boston 10, Mass., are outlined in a pocket-size two-color booklet published by that company. Included are extrusion of thermoplastics, compounding vinyl plastics, Spralon wire insulation, and Surco insulating tubing.

● The U. S. Department of Commerce has announced the availability of 3 reports:

One (PB-4663) is on low thermal expansion plastics developed at Massachusetts Institute of Technology which are said to match thermal expansion coefficients of metals and which can be used with them. This may be obtained in photostat for $3.00 or in microfilm for 50 cents.

The second report (PB-12467) contains information on 19 major developments in the field of plastics in Germany believed to be particularly adaptable by American industry. This was prepared by J. M. DeBell, W. C. Goggin and W. E. Gloor for the Quartermaster General and is available in photostat for $25.00 or microfilm for $4.00.

An improved testing apparatus for determining heat distortion properties of plastics is described in report PB-4664, prepared by Paul F. Ast, which is obtainable in photostat for $1.00 or microfilm for 50 cents.

Mail orders for any of the above should be accompanied by check or money order, payable to the Treasurer of the United States, and should be addressed to the Office of the Publication Board, Department of Commerce, Washington 24, D. C.

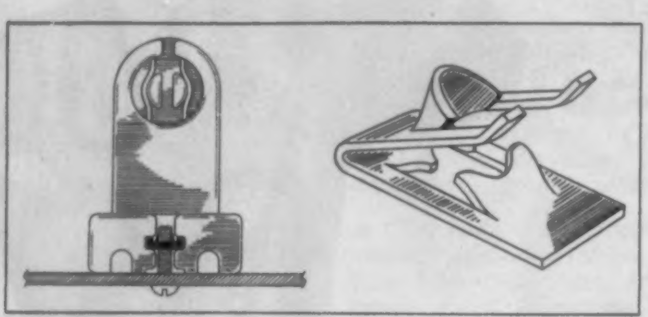
● Aircraft Screw Products Co., Inc., Long Island City 1, N. Y., has released a bulletin (No. 300) on the Heli-coil system for replacing stripped threads. Illustrated instructions show how to install the special coils in tapped thread repair work.

● The American Society for Testing Materials, 260 S. Broad St., Philadelphia 2, Pa., has announced the fifth edition of the compilation of A.S.T.M. Standards on paint, varnish, lacquer and related products, giving in convenient form the more than 160 specifications, tests and definitions issued by that organization. The 540-page book sells for $2.75.

Sorry!

● In this section of the March issue in reviewing the text, "Instruments and process control," developed by the Curriculum Laboratory at Cornell University in cooperation with Taylor Instrument Companies, we failed to mention that the book could be obtained for $2.75 from Delmar Publishers, Inc., 49 Sheridan Ave., Albany 6, New York.

New Machinery and Equipment



● Tinnerman Products, Inc., Cleveland 13, Ohio, has developed a fastener for fluorescent lamp assemblies which is self-retaining and self-locating. When speed nut C6800 is inserted in the recess in the lamp socket, the turned-up ends of the spring arms bite into the plastic and lock the nut firmly in place. As for the assembly units self-locating feature, the extruded collar butts up against the back of the vertical slot in the socket when the fastener is pressed into the recess to accurately locate the nut in screw-receiving position. The fastener has an exclusive spring tension lock which insures an attachment that will remain tight under the most severe vibration conditions, and it may be used with any fluorescent socket of the type shown in the accompanying illustration. Made of SAE 1060 steel, the fastener is tempered and finished with soluble oil dip.

● Raytherm, a new dielectric heating unit, has been introduced by Industrial Electronics Div. of Raytheon Mfg. Co., Waltham, Mass. Model D5G, the 5-kw. general purpose unit, is 5 ft., 11$^{5}/_{8}$ in. high by 2 ft., 4 in. wide and 3 ft., 10$^{7}/_{8}$ in. long. Complete in one cabinet, Raytherm is made of heavy gage sheet metal ribbed for strength on a welded, structural shape framework. Maximum Kv.a. demand from a 230 or 460-v., 3-phase 60-cycle line is 13.3. Each unit is complete with meters, cycle timer, interlocks, safety switch and all necessary control circuits for push-button operation.

● A new power-operated plastics injection press of 1 oz. capacity has been made available by Van Dorn Iron Works Co., Cleveland 4, Ohio. The plunger injection and mold closing are operated by hydraulic cylinders. A gear type pump is driven by a 2-hp. electric motor and develops up to 1500 lb. line pressure. Automatic parts ejection by simple knock-out and ejector pin arrangement eliminates handling of molds and speeds up removal of finished parts. Automatic temperature control is provided by heating bands arranged in two zones, the temperature in each zone being maintained by an individual thermostat within $\pm 6°$ F. Minimum mold thickness is 3 in. and maximum mold thickness 8$^{1}/_{2}$ in. Platen area is 8 by 8 in. and mold opening 6 in. The 1-oz. injection capacity may be used for producing either single or multiple parts totaling that weight.

● For converting standard single-purpose machine tools and fixtures to automatic or semi-automatic production units, Electro-Air Devices Co., Chicago 18, Ill., has announced the low-voltage 24-v. Electro-Air control. This unit may, according to the manufacturer, be used with any standard air cylinder and can be furnished to provide either single- or multiple-cycle control with the addition of cycle timing hesitation limit switches to perform a variety of operations such as automatic drilling, tapping, milling, indexing, holding, etc. Some of the advantages claimed are more compact design which permits mounting anywhere on the machine with no hinderance to the operator's motion or vision; absence of close-fitting ports or valves which tend to wear after long service periods; low voltage which reduces accident hazards and assures longer life for the electrical units; flexible application and easier and quicker installation on machine or fixture. The basic Electro-Air control units consists of a step-down transformer (115–220 v.a.c. to 24 v.), Enbloc (manifold type) solenoid valves, pressure regulator, needle valves and armature of stainless steel.

● A new Thor pneumatic impact wrench, claimed by its manufacturer, Independent Pneumatic Tool Co., Chicago 6, Ill., to

be the lightest and smallest of its class, removes, nuts, bolts and cap screws up to $^{3}/_{8}$ in. thread size. Set at a wide radius from the spindle center, its rotatively striking impact jaws reduce stress, and a short rigid spindle shank delivers the blow close to the work. Weight of the unit has been reduced to 3$^{3}/_{4}$ lb. and length to 4$^{7}/_{8}$ in. by the elimination of fastenings in the mechanism and the compact streamlined design of the housings.

● A new 30-in. reel combination haul-off capstan and take-up for reeling coated wire has been put on the market by National Rubber Machinery Co., Akron, Ohio. Because of its low cost, it is particularly adaptable for small plants. The essential difference between this new unit and conventional equipment is that it combines the capstan and take-up in one compact assembly. An added feature is the torque motor reel drive, providing smooth variable wire tension. A marked saving in cost comes from the unit's single-reel design. Shear-type rubber mountings eliminate the excessive vibration often associated with reeling operations.

News of the Industry

● Nuplamold, made by New Plastic Corp., Hollywood 38, Calif., has been developed for the making of flexible molds suitable for the casting of complex shapes and forms. Although tough and rubbery at room temperature, Nuplamold becomes liquid at 300° F. and is easily poured to form any desired mold. Further, the material is resistant to water, alcohol, acids and heat, characteristics that permit the baking of phenolic casting resins and the pouring of hot waxes and low-melting alloys into the mold. When cooled, reproductions can be cast from such materials as plaster of Paris, alum compositions, alloys having low melting points, liquid phenolic and urea casting resins, hot waxes, soap and other materials.

● Organic Chemicals Div., Dewey and Almy Chemical Co., Cambridge, Mass., has announced the full-scale production of the first of the Darex copolymers series. Among the features claimed for these new materials when used as processing aids and compounding ingredients are: abrasion resistance and flexibility in GR-S and natural rubber shoe soles and top lifts; hardness and tensile strength in molded semi-hard rubber electrical and automotive parts; dielectric strength and moisture resistance in GR-S, GR-I and GR-M wire insulation; increased ease of flow and reduced shrinkage in molded goods; better surfaces in calendered and spread goods. The copolymers are compatible and may be combined with natural rubber, GR-S, Buna N, butyl and neoprene synthetic rubbers and with various types of plastics.

● A rubber-like plastic, called Duroflex, has been developed by Duorite Plastic Industries, Culver City, Calif. Replacing plaster and glue gelatin for mold fabrication, this material can be made into a mold simply by being melted and poured over a clay model of the object to be cast. It can be reclaimed by heating because it is a non-vulcanizable thermoplastic. Coating with lacquers and waxes to insure smooth surfaces is said to be unnecessary.

● A surface coating grade of furane resin has been developed by Furane Plastics & Chemicals Co., Los Angeles 26, Calif., which can be activated with a small amount of catalyst and spread upon various types of porous surfaces, such as concrete, wood, composition boards, plaster. Imperfections and defects in these materials are concealed and the coating will dry in $^1/_2$ hr. after application and set hard overnight. The coating is said to provide chemical inertness to acids, alkalies, solvents and water.

● Condor Plastics Corp., New York 10, N. Y., has moved to larger quarters in Woodside, N. Y. This change will greatly increase its capacity of plastic model and mold making.

● Sun Plastics, Inc., New York, has been organized for the injection molding of plastics. Mr. Glass heads the new firm in the capacity of president.

● War Assets Admin. has announced the sale of the Brooklyn plant of Air Reduction Sales Corp. to Elm Coated Fabrics Co. The new plant will produce plastic and rubber coatings for fabrics.

● Beacon Co., Boston, Mass., has announced the commercial availability of Palmalene, a new palm fatty acid. The new material is said to have many uses: for textile specialities, soap making, alkyl resins, polishes, wetting agents, cosmetics, driers, for pulp and paper manufacture.

● A new engineering department, headed by M. E. Burkhart as vice president, has been created by K. P. Wesseling Co., St. Louis, Mo., for consultant service.

● Plasticote Co., Paterson 4, N. J., will henceforth operate under the name of Plasticote Fabrics Corp.

● To provide a flawless polish for molds, Acme Scientific Co., Chicago 7, Ill., has provided a new mold polishing service. The method is based primarily on lapping and optical polishing.

● Polymer Corp., Reading, Pa., an affiliate of Atlantic Plastics, Inc., has inaugurated a new service for initial samples or small production runs of rods of cellulose acetate, ethyl cellulose and acetate butyrate in diameters of $^1/_4$ to 5 in. Also available are rods, in a smaller range of sizes, of polystyrene, Cerex, Geon, polyethylene, Styraloy and nylon.

● Art Roll Leaf Stamp Co. has moved to larger quarters in Union City, N. J. This company specializes in roll leaf and hot stamping of plastics.

● Plastic Molders, Inc., Philadelphia, Pa., has been organized to do compression custom molding. Facilities will also be available for the design and manufacture of molding dies and metal assemblies. Myron B. Sloane is president and Bernard J. Marconi, plant superintendent.

● The third Plastics Exhibit and Conference sponsored by the Society of Plastics Engineers will be held in Chicago during the month of January 1947. This decision of the National Board of Directors was announced by Mr. William Hoey, executive secretary of the Society, at the June 12th meeting of the Newark Section. This site for the Convention was suggested by all of the exhibitors in the 1946 show.

● New trademarking and imprinting inks have been announced by Acromark Co., Elizabeth 4, N. J. They are for use on plastics, synthetic and natural rubbers, enamel, lacquer and for plastic and rubber insulations on wire and cable. The inks can be furnished in standard colors in both liquid and paste form.

● As a result of extensive research to supplement metallic naphthenates, Nuodex Products Co., Inc., Elizabeth, N. J., has developed Nuocides, a line of fungicide concentrates to meet mildew and rot proofing needs in the textile, lumber, paint, cordage and other industries. Nuocides can be processed, without heating, into ready-to-use preservatives or added in chemical processes and impart a high degree of resistance to mildew and rotting.

● Electroforming Co., processors of metal molds by electroplating, will, in the future, operate under the name of Hartland Plastics, Inc., Hartland, Wis.

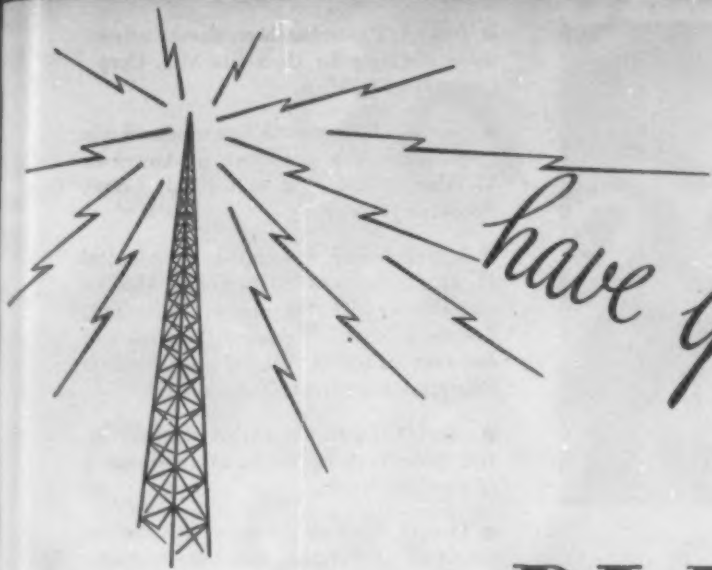
● Allen-Bradley Co., Milwaukee, Wis., manufacturers of Electric controlling apparatus, has moved its Boston office to larger quarters at 55 Oliver St. to provide for office and warehouse facilities.

● E. W. Bliss Co., producers of stamping presses, rolling mills and other equipment, has announced the removal of its executive offices from Brooklyn, N. Y., to 450 Amsterdam St., Detroit, Mich.

● A new firm has been incorporated to specialize in molds and dies for the plastics industry. Stokes Trenton, Inc., Trenton, N. J., is headed by W. J. B. Stokes, II, Chas. C. Davis and John W. Devey. They were formerly with Jos. Stokes Rubber Co.

Sorry!

● In the item describing the trouser hanger made by Pioneer Products Co. which appeared on page 93 of the May issue, the trousers should have been shown suspended from the cuffs between two of the bars. Skirts are hung by the belt in a similar manner.



have you heard?

PLEXIGLAS

is on the radio

Grille for this Emerson Model molded by Plastimold Inc. and Victory Plastics.

¶The new Emerson radios are attracting wide attention. Particularly this attractive table model with its grille of lustrous PLEXIGLAS. This crystal-clear plastic forms a shield over the dial, a sparkling grille over the speaker... gives added distinction to a beautiful design.

¶Your own products can be similarly enriched by the use of PLEXIGLAS. Easily fabricated and molded, PLEXIGLAS lends itself readily to even the most intricate designs. From bottle closures to boudoir furnishings, the unusual properties of PLEXIGLAS can supply just the extra eye-appeal you want.

¶Call or write our nearest office for information or technical assistance: Philadelphia, Detroit, Los Angeles, Chicago, New York. Canadian Distributor: Hobbs Glass, Ltd., London, Ontario.

Only Rohm & Haas makes **PLEXIGLAS** *Acrylic Plastic Sheets and Molding Powders*

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Manufacturers of Chemicals including Plastics . . . Synthetic Insecticides . . . Fungicides . . . Enzymes . . . Chemicals for the Leather, Textile, Enamelware, Rubber and other Industries

● Electronic Corp. of America has established new headquarters at 170 Fifty-third St., Brooklyn 32, N. Y.

● The American Book Center for War Devastated Libraries, Inc., has made an urgent plea for the donation of technical books and periodicals to be sent abroad to aid in the rehabilitation and reconstruction of Europe and the Far East. All shipments should be sent prepaid via the cheapest means of transportation to the American Book Center, c/o the Library of Congress, Washington 25, D. C.

● Merchants Chemical Co., Stamford, Conn., has been newly formed for the manufacture of industrial coatings and finishes. Victor F. Mutch, president, was formerly president of Cordo Chemical Corp. The company has acquired the license rights for Co-res-co, Cordo-clad and Cordo-flex.

● Blue River Plastics Co., New York, N. Y., which also operates under the name of F. T. Nussbaum Co., has announced its removal to more spacious quarters at 329 Canal Street.

● General Aniline & Film Corp. is constructing a complete semi-works and pilot plant at Grasselli, N. J., for the manufacture of new chemical products from acetylene by the high-pressure method.

● Milton M. Schrager and Seymour J. Wolf have announced their organization of the Wolf-Schrager Corp., Far Rockaway, N. Y. This new company will specialize in the building of plastic molds and the molding of plastic products.

● For the investigation and improvement of molding, mold designs, design procedures and fabricating fundamentals, Shaw Insulator Co., Irvington N. J., is constructing a new laboratory building. The staff will be under the direction of J. H. DuBois, executive engineer. The new departmental assignments are: Ivan J. Amo as production manager; Archie A. Christian, production engineer; William F. Condon as the sales engineer; Wayne F. Robb, research engineer; Stanford H. Shaw, thermoplastics product engineer; David H. Smith, licensing manager; and Sumner E. Tinkham, tool and product engineering manager.

Personnel changes

● Benjamin O'Shea has retired as chairman of the board of directors of Union Carbide and Carbon Corp., New York, N. Y., although he will continue as director and member of the executive committee. The corporation also announced that Fred H. Haggerson and all other officers were re-elected.

● Glenn L. Martin Co., Baltimore 3, Md., has appointed Harold M. Parsekian as director of its Plastics and Chemicals Division.

B. Franklin Conner

● B. Franklin Conner has recently been named executive vice-president of Colt's Patent Fire Arms Mfg. Co. He will also be in charge of operations of the arms, Autosan and plastics division.

George E. Vybiral

● According to a recent announcement by Panelyte Div., St. Regis Paper Co., New York, N. Y., George E. Vybiral has been named assistant chief engineer.

● Harold Henderson has returned to the Detroit staff of Formica Insulation Co., Cincinnati, Ohio.

● Monsanto Chemical Co., St. Louis 4, Mo., has made a number of personnel changes recently. Paul G. Marsh is production manager and J. Kenneth Craver, coordinator of plasticizers and resins for the Organic Chemicals Div.; A J. Pastene succeeds Mr. Marsh as manager of the John F. Queeny plant in St. Louis; E. T. Stehlby is assistant plant manager, and Roy G. Hemminghaus, Walter Meyer and J. W. McCrackin, manufacturing superintendents of the Queeny plant. Robert E. Holmes has been made divisional export manager at Everett, Mass.

● John J. Paige has been named advertising manager for Haskelite Mfg. Corp., Grand Rapids, Mich.

● Gerald Bamberger has resumed his position as vice president of American Molding Powder & Chemical Corp., Brooklyn 11, N. Y.

● Milton Harris Associates, Washington 11, D. C., have added Louis R. Mizell and Howard H. Brandt to their staff. Louise L. Cox is technical librarian and assistant editor of *Natural and Synthetic Fibers*, published by this organization.

● Carl J. Lamb has joined Hydropress, Inc., New York 22, N. Y., in the capacity of vice president.

● Don G. Mitchell was recently elected president of Sylvania Electric Products, Inc., New York, N. Y. Former president, Walter E. Poor, is now chairman of the board of directors and Robert H. Bishop, director of sales.

● Harold L. Aldrich is the new New York district representative for General Electric Co.'s Chemical Department.

● Ronald Clarkson, formerly with F. J. Stokes Machine Co., has announced the opening of his office as a tablet consultant in Philadelphia, Pa.

● Stuart O. Fiedler has been named manager of the So. Chicago branch of Bjorksten Laboratories, Chicago 1, Ill.

● Arthur E. Giesler, formerly with the radiation laboratory of M.I.T., is now in the engineering division of Electric Auto-Lite Co., Toledo, Ohio.

● Richard M. Gottlieb resumes his vice-presidency in M. M. Gottlieb Associates, Inc., Allentown, Pa.

● At the annual board meeting of Wheelco Instruments Co., Chicago, Ill., Claude A. Gates and C. H. Joy were made vice presidents of the company. R. A. Schoenfeld, presently a vice president, was named a director, and Charles L. Saunders, also a vice president, was appointed to the office of executive vice president.

● Watson-Standard Co., Pittsburgh, Pa., has appointed Joseph M. Perrone director of research.

● Harold J. Cook has been appointed controller of Manufacturers Chemical Corp., Berkeley Heights, N. J., and its subsidiary, Chemaco Corp. This appointment was necessitated by the increased production and sales volume which resulted from the corporation's expansion program inaugurated several months ago.

● George P. Lehmann has been appointed to the newly created post of assistant manager of the Plastics Div. of General Electric Co., Pittsfield, Mass.

Preparation of polystyrenes

(*Continued from page 153*) and the product becomes semi-solid. Reaction time: approximately 3 hours.

Third step: The vessel containing the semi-solid substance is placed in a hot oil bath and the final polymerization is done at 160 to 170° C. After cooling, the product is spring-hard. Reaction time: approximately 8 hours.

The product is broken up by hand and then in a crusher to a particle size of 0.1 to 1.0 cm. Approximately 5 tons/month can be produced with the available equipment.

At the request of the Army, one batch was produced without catalyst and at a higher temperature. The experiment was run at 100° C. After $1^{1}/_{2}$ hr. a reaction of such violence started that it was only possible to run the substance into the iron vessel where it expanded explosively to seven or eight times its initial volume. Since the reaction without catalyst at lower temperature proved to be too slow, the experiments that were being carried on without catalyst were soon discontinued.

Pearl polymerization

Pearls—Difficulties in the production of pearls involve the exact proportions of the addition agents, such as talcum, Tonalon, E 1000 and benzoyl peroxide, the stirring speed which varies with each kettle, and maintenance of the required initial temperature (80° C.), reaction temperature (50° C.) and the final temperature (95° C.). The correct proportioning of all these factors results in the desired pearl size. This proportioning has also been found to prevent the formation of lumps or coarse particles. Approximately 400 kg./month of the material can be produced at present with the equipment that is available for the work.

Foamed pearls—The pearls can be transformed into a foamed condition by drying them in vacuo at high temperature.

A gage for measuring sandwich construction

Plastics men will be interested in a gage that has been developed by the Glenn L. Martin Co. for measuring the number and thicknesses of layers in sandwich-type construction. The instrument can also be used for inspection of bonds between the laminar layers of laminated materials—a deflection of a number of degrees, when registered on the dial at the top of the unit, indicating a faulty bond in a particular layer of the laminate being tested.

The device can also be calibrated to inspect the thickness of single sheet materials of any size. Heretofore the measuring of depths of large single sheets presented a problem since micrometers were not so designed as to be able to calculate center areas.

The gage operates on the pressure principle and consists of an outer shell with a transparent top. Inside the shell is a dial indicator. It is equipped with a spherically shaped foot which contacts the material to be measured. A valve emerging from the top of the case is connected to a pump for withdrawing and inflating pressure to any desired amount.

In use, the valve is first opened to allow it to reach a normal pressure. The reading taken acts as a standard for the test. The valve is then closed and the air evacuated. Where faulty bonds in the material are located they will cause that section of the material to pull away from other layers touching the foot gage and the dial indicates the deflection.

Glass cloth, fabrics impregnated with resins and various types of plastics can be measured with the gage as can such other materials as wood and metal.

Cementing and assembly of plastics

The fifth chapter for the Technical Handbook, issued by the Society of the Plastics Industry, will be entitled "Cementing and Assembly of Plastics."

As suggested by the title, the chapter treats the basic processes of joining and bonding plastics. One section covers mechanical assembly by rivets, screws, inserts and bolts. The second and third parts deal with cementing of thermoplastics and thermosetting plastics. Bonding of plastics to other materials by means of heat welding or cementing is also discussed at considerable length.

The chapter carries the authority of the four authors who collaborated in this work—John Sasso, *Business Week;* G. A. Wilkens, E. I. du Pont de Nemours & Co., Inc.; H. F. Wakefield, Bakelite Corp.; and S. Kaufman, Canadian General Rubber Co., Ltd. A number of illustrations and an index of cementing and bonding agents also help to make this chapter a comprehensive guide for all those engaged in these important operations.

Since a heavy demand for this chapter of the Handbook is anticipated, the Society urges the placement of orders before July 15, publication date. Copies may be obtained for a nominal fee from the Engineering & Technical Committee, Society of the Plastics Industry, Inc., 295 Madison Ave., N. Y. C.

Manufacture of Koresin

(Continued from page 151)

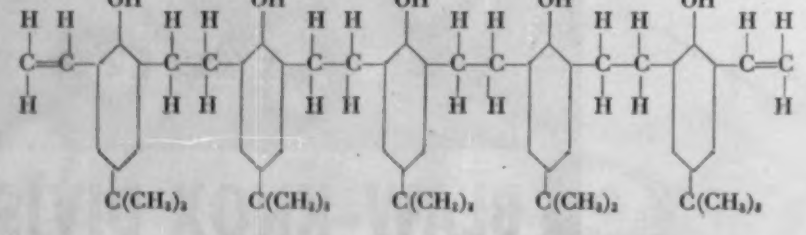
The mixture of phenol and catalyst is heated to 100–120° C. under a pressure of 10–20 mm. of mercury to remove moisture. It is then forced by nitrogen under pressure (2 atmospheres) into the autoclave which has a capacity of 1500 liters. The autoclave is steam-jacketed and heated to 210–220° C. by steam at 20 atmospheres pressure. The mixture in the autoclave is stirred and all air swept out by nitrogen.

The acetylene is then pumped into the autoclave. The addition of acetylene is so arranged that the total amount, 200 kg., is introduced over a period of from 14 to 16 hours. The pressure at the start is 10 atmospheres at a temperature of 180° C., but during the course of the reaction the pressure rises to 20–22 atmospheres and the temperature to 230–235° C. When the required amount of acetylene has been added, the mixture is stirred for another hour. The molten product is then discharged by the pressure in the autoclave to a vessel in which it is stirred to remove unreacted acetylene. The resin is then run into barrels of 125 kg. capacity or it is solidified, ground and packaged in bags of 75 kg. capacity. It has a melting point of 120–130° C. The output of Koresin was 40–50 tons per month per autoclave of 1500 liter capacity. Three such units were in use. The yield was 93–94 percent based on the total components. Its production was started in 1938.

Most of the approximately 150 tons/month of Koresin produced was used with Buna S to the extent of 1 to 5 percent in the formulation of tire carcass compounds. The supply was not sufficient to meet the demands of the industry and hence it was allocated only to highly important end uses. Koresin was also considered to be particularly desirable for tread cement and ply freshening solution in tire manufacture. A typical formula for the latter purpose is as follows:

Koresin..................	3 parts by weight
Cyclohexanone............	5 parts by weight
Toluene..................	5 parts by weight
Gasoline.................	87 parts by weight

Due to the shortage of cyclohexanone and toluene, 10 parts of benzene were substituted for these during the latter part of the war.



2—Structure of this synthetic resin made by reaction of acetylene and p-tertiary-butylphenol in zinc naphthenate presence

Correlation between properties

(*Continued from page 158*)

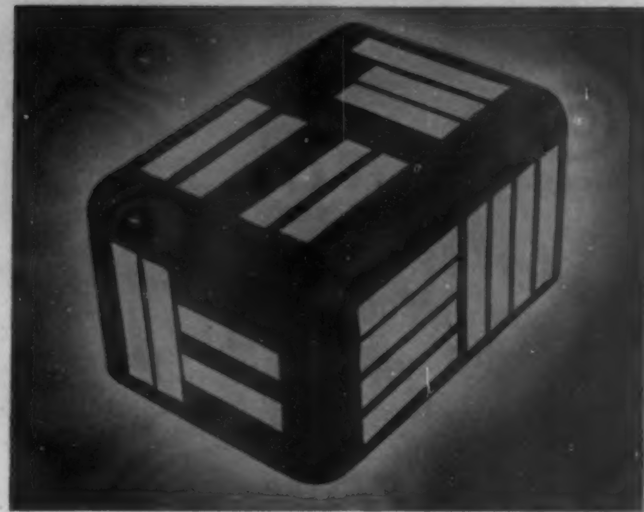
Good correlation is observed for the short-fiber materials (bulk factors less than 4) and long fiber materials (bulk factors greater than 4), respectively, but different proportionality factors are involved for the two classes of materials.

Strength properties of molded boxes

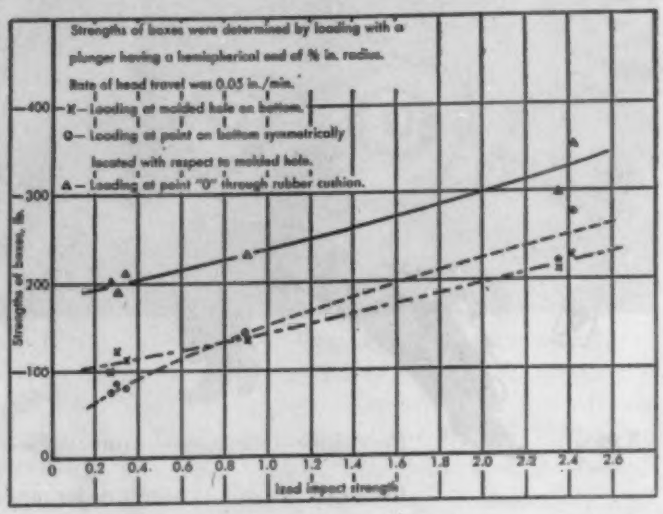
The flexural strengths of specimens cut from the molded boxes are compared with data obtained on specimens from the 1/8-in. thick molded flat sheets in Table XII. The locations of the specimens cut from the boxes are shown in Fig. 16. The smoother outer surface of the boxes was made the tension side of the beam. The strengths of specimens from the boxes are in good agreement with the strengths of specimens from the 1/8-in. thick sheets, except for boxes that are made of BM-250.

The reduced strength of the asbestos-filled material BM-250 may be caused by a number of factors. The boxes of this material were molded from preforms instead of loose powder which was used for boxes of the other materials. BM-250 is the only mineral-filled material represented and has a mold shrinkage less than that contemplated by the mold designer. The significant difference observed for specimens cut at right angles to one another suggests that the direction of flow from the single preform results in a special orientation of filler in this molded box.

The breaking strengths of the boxes molded from the six phenolic materials are given in Table XIV. A comparison with the flexural strengths of specimens cut from the molded boxes is shown in Fig. 14. The strength of the boxes does not correlate with any of the



16—*Locations of specimens cut from the molded boxes*



17—*Box strengths compared with Izod impact strengths*

Table XIV.—Strength Tests on Molded Boxes

Material	*Batch No.*	*Loading at molded hole*[a]			*Loading at point on bottom of box symmetrically located with respect to molded hole*					
					Without rubber cushion			*With rubber cushion*[b]		
		No. of tests	*Breaking load*		*No. of tests*	*Breaking load*		*No. of tests*	*Breaking load*	
			Average	*Range*		*Average*	*Range*		*Average*	*Range*
			lb.	*lb.*		*lb.*	*lb.*		*lb.*	*lb.*
BM-45	182A	3	98	88–108	3	75	75– 76	3	200	181–214
BM-120	744C	3	121	114–132	3	84	82– 87	3	188	184–190
BM-6260	1221	3	113	108–120	.	..	...	.	..	...
	1359	.	..	...	3	81	79– 83	3	211	192–242
BM-250	202D	3	147[c]	132–160	2	172[c]	144–200	3	230[e]	226–238
	207H	3	129[d]	122–133	3	112[d]	104–122	.	..	...
BM-200	27	3	213	206–220	2	218	172–244	.	..	...
	23	.	..	...	.	..	...	1	298	...
BM-3510	1985	3	249	232–2[illegible]2	3	274	252–290	.	..	...
	2112	3	203	198–206	.	..	...	3	353	322–374

[a] Boxes were loaded at the indicated points with a plunger having a hemispherical end of 3/8 in. radius. Rate of head travel was 0.05 in./min.
[b] Rubber cushion consisted of a No. 7 rubber stopper placed with larger face next to box.
[c] Boxes had numerous small cracks in a variety of locations. Boxes were cooled before ejection.
[d] Boxes were cured at 320° F. for 5 min. and ejected hot. This improved the appearance of moldings.
[e] Boxes were molded at a later date than the others of this batch.

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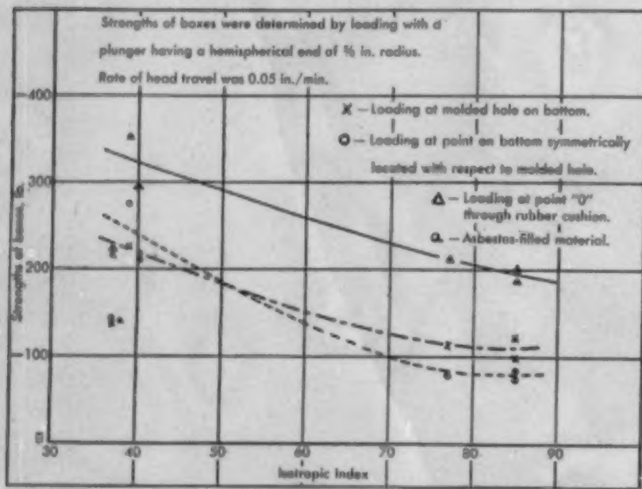
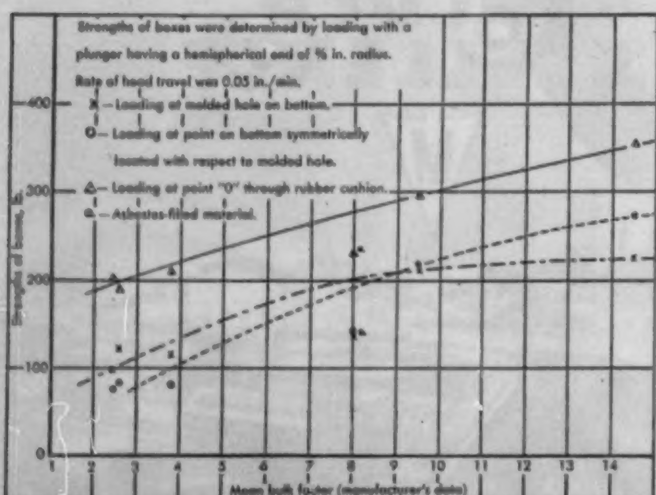
tensile or flexural strengths that have been determined after considerable number of tests in the course of this investigation.

The failure of the boxes made from the short-fiber materials was sudden and complete. The boxes made of the long-fiber materials showed signs of failure at about the same load which caused complete failure of the short-fiber materials but were able to withstand considerably higher loads in spite of numerous cracks. The manner of failure was very similar in almost all respects to the failure of the flat sheets used in the falling-ball test.

A comparison of the strengths of the boxes with the results of the falling-ball test on the $^1/_4$-in. thick sheets is shown in Fig. 15. Correlation of the strengths of the boxes with the results of the Izod impact test on standard molded specimens is shown in Fig. 17, with the isotropic index as determined on molded cylinders in Fig. 18, and with the bulk factors of the molding powders in Fig. 19. The last two comparisons show a significant



18—*Strengths of the boxes correlated with the Isotropic Index*



19—*Strengths of boxes correlated with the bulk factors of powders*

difference between the mineral and the cellulose-filled materials.

Of the data usually reported in the manufacturers' bulletins, the Izod impact strength is the best index of the strength of the boxes. The results are in agreement with the current practice of designing on the basis of impact resistance.[10] The strengths of articles of other shapes which would not permit the distribution of the load by partial failure would not be expected to show similar correlation.

Variability of materials

Coefficients of variation have been reported for most of the test results. The coefficients of variation obtained with small samples are themselves quite variable as would be expected. The materials containing larger pieces of filler are much more variable than the materials containing woodflour or short cotton flock, particularly in the flexural tests. Thinner moldings of the materials containing fibrous fillers have higher flexural strengths, as stated by the manufacturers, but at the expense of increased variability (Table IV). Coefficients of variation of larger tensile specimens of both dumbbell and dogbone types are less than coefficients of smaller specimens although the strengths show little change with cross section if the length of the specimen is kept constant (Table VI).

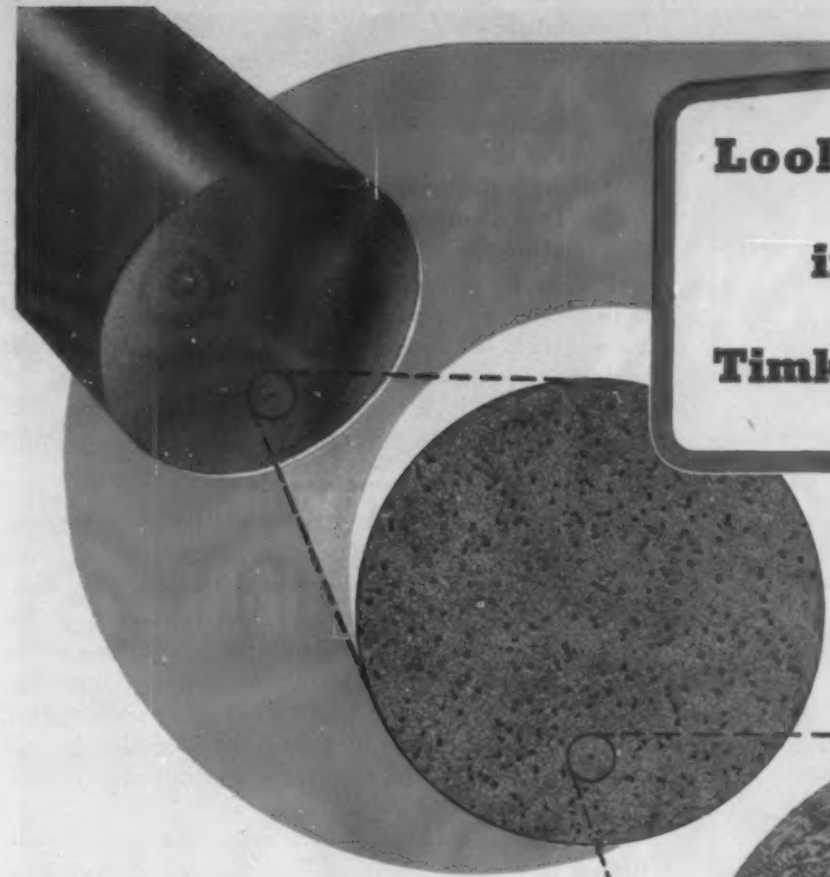
In the flexural tests high results were usually accompanied by off-center failures. Low results were obtained when a discontinuity of the filler occurred on the tension face of the beam at midspan. It should be noted, therefore, that both the flexural strengths and the variabilities of the fabric-filled materials determined with the $^1/_8$-in. thick specimens would have been lower if the strength had been calculated for the stress at the point of failure instead of for failure at midspan.

The largest samples were used for tests of specimens cut from the molded boxes. Coefficients of variation calculated for these results are considered to be typical of the materials. Frequency-flexural strength diagrams for the six phenolic molding materials are shown in Fig. 20. The difference in the flexural strength of BM-200 when tested at span-depth ratios of 16:1 and 8:1, respectively, is 700 p.s.i. or about 6 percent (Table III). The coefficient of variation considered to be typical of this material in $^1/_8$ in. thickness is 16 percent (Table IV and Fig. 20). In order to establish the significance of the difference in flexural strength it would be necessary to make 130 tests at each span-depth ratio.

The use of the five specimens usually required for routine tests of plastic materials is definitely inadequate for determining small differences for such variable materials. For example, five specimens of the abovementioned material would be sufficient only to establish the significance of a difference of about 30 percent or even more.

The nonuniformity of a material, which is indicated by the coefficient of variation, affects the results of tests made with specimens of different sizes and tests

[10] W. S. Larson, "Interpretation of mechanical data necessary in plastic part design," Product Engineering *15*, 469–472 (July 1944).



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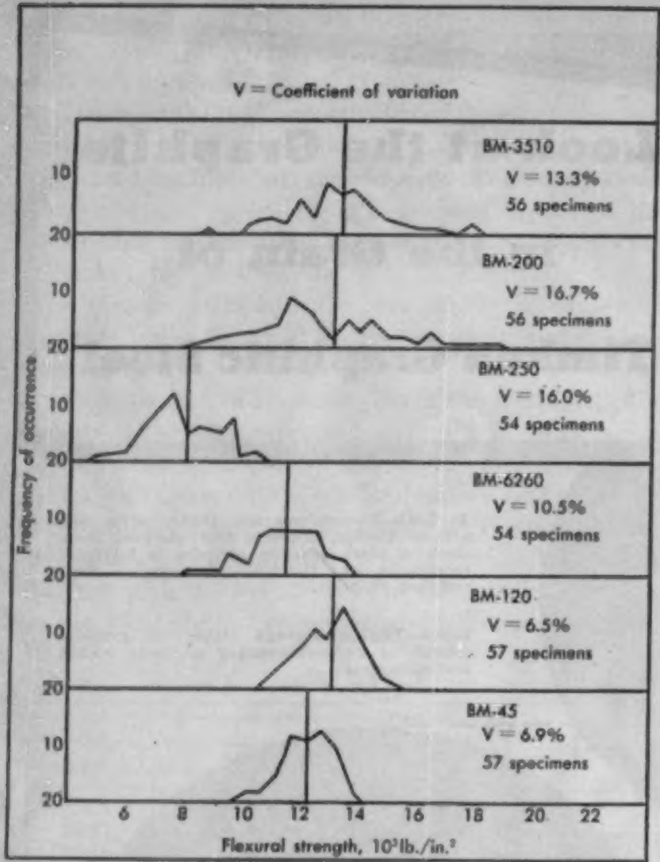


20—Frequency-flexural strength diagrams, specimens are from the boxes

with different methods of loading. Tucker[11] presents a treatment of the statistical theory of the effects of dimensions and methods of loading upon strength properties, wherein the "weakest link" theory, developed independently by Weibull,[12] and the "strength-summation" theory are discussed in relation to the strength of concrete beams.

The statistical analyses as verified by tests on concrete beams indicate that the modulus of rupture (flexural strength) is independent of the width of the beam, but is decreased by an increase in thickness or length. The first two of these conclusions are substantiated by the results reported here of tests on specimens of different widths and thickness cut from the molded flat sheets. The most variable materials show the greatest differences with thickness. The conclusion regarding the effect of length was not checked because it was not possible to isolate the independent effect of span-depth ratio.

The "weakest-link-in-series" theory proposed by Weibull indicates that smaller tensile specimens (shorter lengths) should have higher strengths. This may partially explain the higher results obtained with the dog-bone specimens although the effect of orientation of the fillers and the effect of the shape of the specimen may be the principal cause of the difference.

The "strength-summation" or "links-in-parallel" theory indicates that the tensile strength should be independent of the cross section and that the coefficient of variation should decrease with an increase in cross section. This is substantially what was observed for the tensile strengths of specimens machined from the $^1/_8$- and $^1/_4$-in. thick molded flat sheets.

In the foregoing discussion the statistical theory has been applied only qualitatively since the coefficients of variation based on small samples are themselves quite variable. The qualitative agreement with the statistical theory indicates that further work would be useful.

Conclusions

Conclusions relating particularly to test specimens and methods of test have been presented in the discussion. These findings indicate that the interpretation of the results of tests must take into consideration the characteristics of the individual filler in relation to the particular test piece. General conclusions follow:

1. Phenolic molding materials are generally non-isotropic. The degree of anisotropy depends on the size and shape of the fillers and the dimensions and shape of the molded section.

2. The nonhomogeneity of these materials is reflected in the coefficient of variation which increases with the size of the pieces of filler and is an important characteristic of each material.

3. The flexural strengths of specimens cut from molded boxes were found to be in good agreement with the flexural strengths of specimens from molded flat sheets of approximately equal thickness. An asbestos-filled material, BM-250, appears to be an exception to this. The reason for the exception is not known.

4. Tensile and flexural stress-strain curves indicate that phenolic resins are essentially brittle. Fibrous materials, however, are capable of relieving localized stress and distributing the load by partial failure.

5. The breaking strengths of molded boxes correlate well with the results of the falling-ball impact test on flat sheets molded of the same materials. Good correlation is also obtained with the Izod impact strength as determined on standard test specimens. Good correlation with bulk factor of powder also was observed.

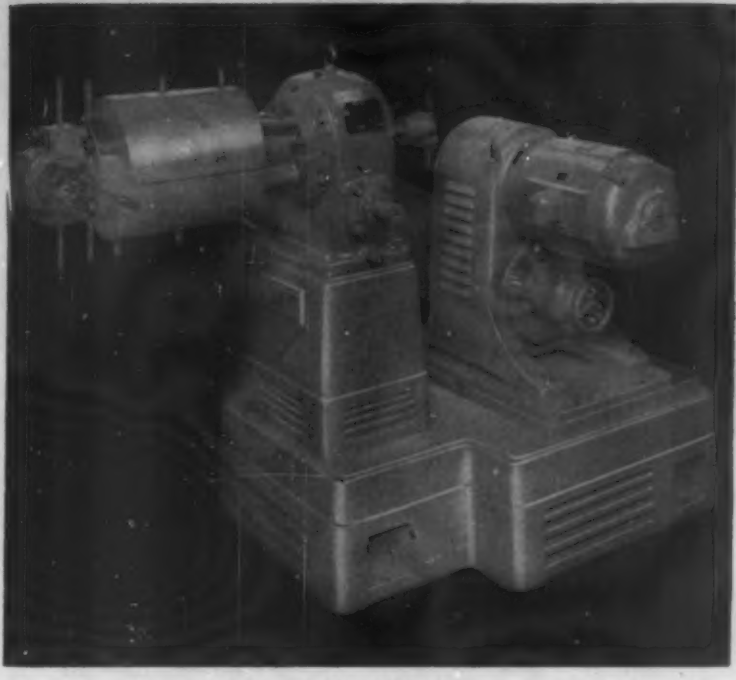
6. The trends observed in this investigation for the behavior of standard test specimens agree qualitatively with conclusions derived from statistical analysis of the effects of dimensions and methods of loading upon the strength properties of concrete beams. It is concluded that further work along these lines is desirable.

Acknowledgment

The molding materials for this investigation were supplied by the Bakelite Corp. and the Monsanto Chemical Company. Flat plates molded in $^1/_8$- and $^1/_4$-in. thicknesses were furnished by the Bakelite Corp. and boxes were molded of the same materials by the General Electric Co., Plastics Division. The cooperation of these firms is gratefully acknowledged.

[11] J. Tucker, Jr., "Statistical theory of the effect of dimensions and method of loading upon the modulus of rupture of beams," Proc. A.S.T.M. *41*, 1072–1088 (1941).

[12] W. Weibull, "A statistical theory of the strength of materials," Proc. Royal Swedish Inst. Engineering Research, No. 151 (1939).



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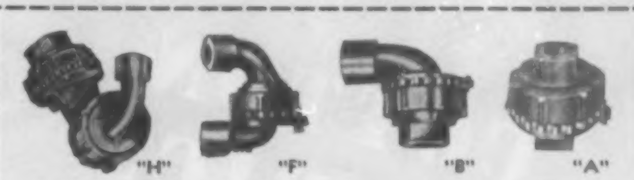

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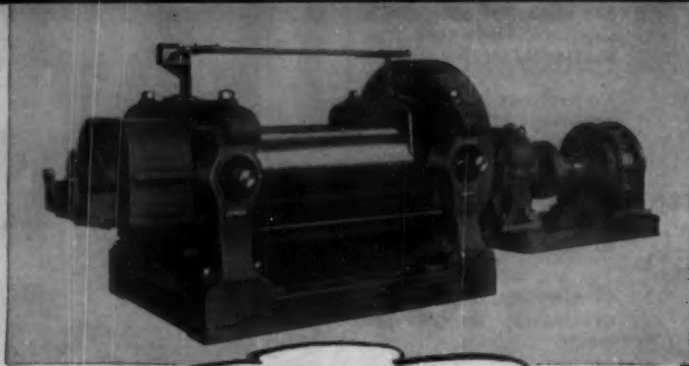

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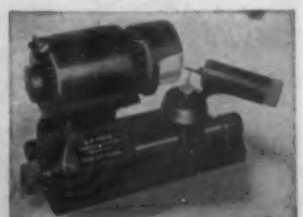

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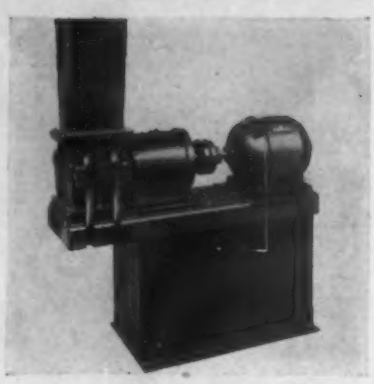

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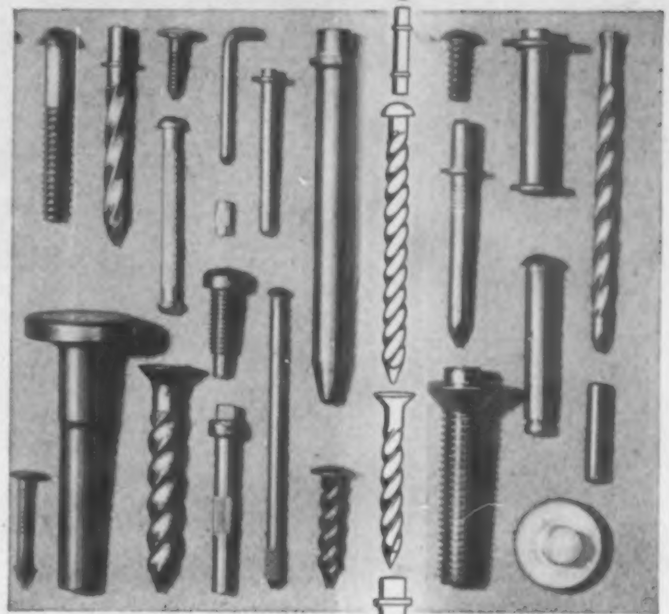

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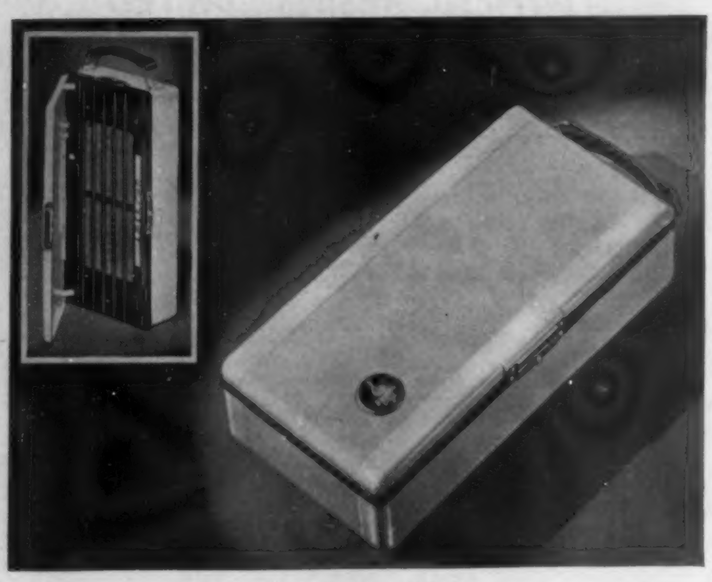

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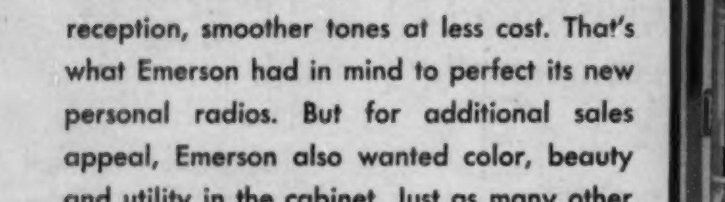

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